UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

MEMORANDUM

Date: August 28, 2008
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PC Code: 122809, 122805

SUBJECT: Ecological Risk Assessment Addressing the Proposed Registration of Fluazifop-p-butyl for New Uses on Peanuts and Dry Beans and Amended Uses on Soybeans

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The Environmental Fate and Effects Division (EFED) has completed the baseline ecological risk assessment for the proposed registration of fluazifop-p-butyl (PC Code 122809) for new uses on peanuts and dry beans and amended uses for soybeans (PC Code 027902). The risk assessment considers the use of fluazifop-p-butyl as proposed on the Fusilade®DX Herbicide label (EPA Reg No. 100-1070) submitted by Syngenta Crop Protection, Inc. Fluazifop-p-butyl is proposed for use as an herbicide to control perennial and annual grass weeds. Conclusions regarding the environmental fate, ecological effects, and ecological risks associated with the proposed uses can be found in the executive summary of the attached document.

Key Uncertainties and Data Gaps

Tables 1 and 2 list all the available environmental fate studies submitted to fulfill data requirements under 40 CFR Part 158 for terrestrial outdoor uses. A complete list of submitted

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ecological effects data may be found in Appendix C. The environmental fate and toxicology data requirements are not adequately fulfilled for the proposed uses.

The following environmental fate data are requested:

- A hydrolysis study (Guideline Number, abbreviated GN, 835.2120) examining the ratio of enantiomers or enantiomer excess in water is needed for fluazifop-p-butyl and fluazifop-p-acid to determine whether fluazifop-p-butyl or fluazifop-p-acid undergo enantiomerization in water as seen for some compounds such as pyrethroids.[1,2]
- Aerobic soil metabolism study (GN 835.4100) with fluazifop-p-butyl that identifies the ratio of enantiomers of fluazifop-butyl and fluazifop-acid in an American soil
- Analytical chemistry methods capable of identifying and quantifying each separate enantiomer and fluazifop-butyl and fluazifop-acid in soil, water, and tissue.[3]

Additionally, the following studies are standard data requirements for terrestrial outdoor uses that have not been fulfilled for the proposed uses. Previously, there was a determination that data would not be needed for fluazifop-p-butyl because of the short laboratory half-lives for the compound. However, terrestrial field dissipation studies do indicate that fluazifop-butyl may be present for days to weeks and therefore, a full data set is needed for fluazifop-p-butyl.

- Photodegradation in Water (GN 835-2240) for fluazifop-p-acid
- Leaching and adsorption/desorption (GN 835.1230 or 835.1240) for fluazifop-p-butyl and fluazifop-p-acid in U.S. soils
- Terrestrial Field Dissipation Study (GN 835.6100) examining degradation of all major degradates and that includes an acceptable storage stability study and analytical method validation
- Validation of analytical methods used in field studies
- Storage stability studies to support terrestrial field dissipation studies

All degradation and analytical method studies should state the enantiomeric purity of the chemical used in testing and the enantiomer ratios in the residue characterizations.

Finally, if future environmental toxicology data on 2-hydroxy-5-trifluoromethylpyridine (degradate X) indicate that it is a risk concern; environmental fate data may be needed.

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[1] Lee, P.W. 1989. Hydrolysis of [Chlorophenyl-14C] DPX-GB800 in buffer solutions of pH 5, 7, and 9. Unpublished study submitted by E.I. du Pont de Nemours and Co., Inc., Wilmington, DE. Laboratory Project ID AMR-1185-88. MRID 40999303.

[2] Qin, S, and J. Gan. 2007. Abiotic enantiomerization of permethrin and cypermethrin: effects of organic solvents. *J. Agric. Food Chem.* 55: 5734-5739.

[3] *EFED Interim Policy for Stereoisomeric Pesticides* (available at http://www.epa.gov/oppefed1/ecorisk_ders/stereoisomer_policy.htm) states, "...Analytical chemistry methods capable of identifying and quantifying each separate enantiomer and chiral transformation products in soil, water, and fish tissue are needed."

Table 1. Summary of fate data requirements for fluazifop-p-butyl and fluazifop-p-acid.

Guideline Number	Study Description	40 CFR § 158 Requirements: Terrestrial Outdoor Use	MRID Number (chemical)[1]	Classification	Are more data needed for this risk assessment?
Degradation Studies – Laboratory					
835.2120	Hydrolysis	Required	41598001 (butyl) 46190601 (acid)	Acceptable Acceptable	Yes, the ratio of enantiomers in water for butyl and acid are needed. Hydrolysis data for the racemic mixture (MRID 87529) indicate hydrolysis rate of pure enantiomer is 2x the rate for the racemic mixture.
835.2240	Photodegradation in water	Required	42543202 (butyl)	Unacceptable	Pending, data is available for racemic mixture Yes for acid
835.2410	Photodegradation on soil	Required	41598002 (butyl)	Acceptable	No for butyl Yes for acid
835.2370	Photodegradation in air	Conditionally required	No data	Not applicable	No due to low vapor pressure
Metabolism Studies – Laboratory					
835.4100	Aerobic soil	Required	162455 (butyl) 46190602 (acid)	Not classified in DER Supplemental due to no material balance and transformation products not addressed	Yes for butyl No for acid because data is available for the racemic mixture.
835.4200	Anaerobic soil	Required	No data	Not applicable	No, data is available for racemic mixture
835.4300	Aerobic aquatic	Required	46190605 (acid)	Acceptable	No
835.4400	Anaerobic aquatic	Required	No data	Not applicable	No, used data for anaerobic flooded soil in absence of data for aquatic environment.
Mobility Studies					
835.1230 835.1240	Leaching and adsorption/desorption	Required	46190603 (acid)	Supplemental due to insufficient mass balance and no soil with <1% organic matter. All soils were foreign soils.	Yes for butyl and acid

Table 1. Summary of fate data requirements for fluazifop-p-butyl and fluazifop-p-acid.

Guideline Number	Study Description	40 CFR § 158 Requirements: Terrestrial Outdoor Use	MRID Number (chemical)[1]	Classification	Are more data needed for this risk assessment?
			46190604 (butyl)	Unacceptable due to heat sterilized soils	
835.1410	Volatility – laboratory	Conditionally Required	No data	Not applicable	No due to low vapor pressure
835.8100	Volatility – Field	Conditionally required	No data	Not applicable	No due to low vapor pressure
Dissipation Studies - Field					
835.6100	Terrestrial	Required	No data	Not applicable	Yes, a field dissipations study is needed that evaluates major degradates including degradate X, which made up as much as 37% of applied equivalents in the aerobic aquatic metabolism study (MRID 46190605)
835.6200	Aquatic (sediment)	Conditionally required	No data	Not applicable	No
835.6300	Forestry	Not required	No data	Not applicable	No, forestry uses were not requested
835.6400	Combination and tank mixes	Conditionally required	No data	Not applicable	No
Ground Water Monitoring					
835.7100	Ground water monitoring	Conditionally required	No data	Not applicable	No
Other					
	Analytical chemistry methods capable of identifying and quantifying each separate enantiomer in water		No data	Not applicable	Yes, methods to detect fluazifop-butyl, fluazifop-acid and other major degradates in water are needed to support water monitoring studies[3,4]
	Analytical chemistry methods capable of identifying and quantifying each separate enantiomer in soil		No data	Not applicable	Yes, methods to detect fluazifop-butyl, fluazifop-acid and other major degradates in soil are needed to support monitoring studies[3]
	Analytical chemistry		No data	Not applicable	Yes - methods to detect fluazifop-butyl,

Table 1. Summary of fate data requirements for fluazifop-p-butyl and fluazifop-p-acid.

Guideline Number	Study Description	40 CFR § 158 Requirements: Terrestrial Outdoor Use	MRID Number (chemical)[1]	Classification	Are more data needed for this risk assessment?
	methods capable of identifying and quantifying each separate enantiomer in fish tissue				fluazifop-acid and other major degradates in tissue are required by the Stereoisomer Interim Guidance[3]
	Validation of Analytical Method and Independent laboratory validation of parent and significant metabolites for soil and water	Required for validation of field studies, *e.g.*, water and soil	No data	Not applicable	Yes
	Storage stability of residues in frozen soil samples	Required	No data	Not applicable	Yes, to support terrestrial field dissipation studies
	Bioconcentration in fish	Conditionally Required	No data	Not applicable	No, data is available for racemic mixture
	Spray droplet size spectrum (201-1)	Required. Data are available. May be satisfied through membership in the Spray Drift Task Force	No data	Not applicable	No - Syngenta Crop Protection, Inc. is a member of the Spray Drift Task Force[5]
	Spray drift field deposition (202-1)				

1 Butyl refers to the parent compound, fluazifop-p-butyl, and acid refers to the acid degradate, fluazifop-p-acid.

2 *EFED Interim Policy for Stereoisomeric Pesticides* (available at http://www.epa.gov/oppefed1/ecorisk_ders/stereoisomer_policy.htm) states, "...an aerobic soil metabolism study (GLN 162-1/835.3300) is required as part of the minimal data set for enantiomeric enriched mixtures."

3 *EFED Interim Policy for Stereoisomeric Pesticides* (available at http://www.epa.gov/oppefed1/ecorisk_ders/stereoisomer_policy.htm) states, "...Analytical chemistry methods capable of identifying and quantifying each separate enantiomer and chiral transformation products in soil, water, and fish tissue are needed."

4 A high-performance liquid chromatography (HPLC) method was submitted to detect fluazifop-acid in water in connection with a ground water monitoring study but it has not been independently evaluated and did not examine the enantiomers present (MRID 40439402).

5 List of Spray Drift Task Force Members available at http://www.agdrift.com/Text%20pages/members.htm (accessed March 28, 2008).

Table 2. Summary of fate data requirements for fluazifop-butyl and fluazifop-acid.

Guideline Number	Study Description	40 CFR § 158 Requirements: Terrestrial Outdoor Use	MRID Number	Classification	Are more data needed for this risk assessment?
Degradation Studies – Laboratory					
835.2120	Hydrolysis	Required	87529	Not classified	No, data is available for fluazifop-p-butyl.
835.2240	Photodegradation in water	Required	93788	Not classified	Pending formal classification of MRID 93788
835.2410	Photodegradation in soil	Required	93789	Not classified	No, data is available for fluazifop-p-butyl
835.2370	Photodegradation in air	Conditionally required			No, due to low vapor pressure
Metabolism Studies – Laboratory					
835.4100	Aerobic soil	Required	87492 87493, 92067032, 92067033	Not classified Supplemental due to insufficient time points to characterize parent and all foreign soils	No
835.4200	Anaerobic soil	Required	87493, 92067032, 92067033	Supplemental due to insufficient time points to characterize parent and all foreign soils	No
835.4300	Aerobic aquatic	Required	No data	No data	No, data is available for fluazifop-p-acid.
835.4400	Anaerobic aquatic	Required	87493, 92067032	Supplemental due to insufficient time points to characterize parent and all foreign soils	No
Mobility Studies					
835.1230 835.1240	Leaching and adsorption/desorption	Required	93794 41900604	Not classified but soil was autoclaved and study would be unacceptable Acceptable for fluazifop-acid and degradate X	No, fluazifop-butyl is no longer registered for use.
835.1410	Volatility – laboratory	Conditionally Required	No data	Not applicable	No, due to low vapor pressure
835.8100	Volatility Field	Conditionally required	No data	Not applicable	No, due to low vapor pressure

Guideline Number	Study Description	40 CFR § 158 Requirements: Terrestrial Outdoor Use	MRID Number	Classification	Are more data needed for this risk assessment?
Dissipation Studies - Field					
835.6100	Terrestrial	Required	41598003	Supplemental; does not completely fulfill guideline requirements because of rototilling of soil	No, fluazifop-butyl is no longer registered for use.
			41598004	Supplemental; does not completely fulfill guideline requirements because major degradates were not monitored and the freezer storage stability study was not adequate	
			87495 & 92067034	Supplemental; does not completely fulfill guideline requirements because of inadequate sampling intervals, application rate not confirmed, and analytical methods were not provided	
			41900605	Supplemental; does not completely fulfill guideline requirements because of rototilling of soil	
			41900606	Unacceptable due to data not corresponding to aerobic metabolism study on degradate amounts	
835.6200	Aquatic (sediment)	Conditionally required	No data	Not applicable	No, fluazifop-butyl is no longer registered for use.
835.6300	Forestry	Not required	No data	Not applicable	No, fluazifop-butyl is no longer registered for use.
835.6400	Combination and tank mixes	Conditionally required	No data	Not applicable	No, fluazifop-butyl is no longer registered for use.

Guideline Number	Study Description	40 CFR § 158 Requirements: Terrestrial Outdoor Use	MRID Number	Classification	Are more data needed for this risk assessment?
Ground Water Monitoring					
835.7100	Ground water monitoring	Conditionally required	40439401	Unacceptable due to nontargeted monitoring	No, fluazifop-butyl is no longer registered for use.
Other					
	Validation of Analytical Method and Independent laboratory validation of parent and significant metabolites	Required for validation of field studies, *e.g.*, water and soil	40439402	This method has not been validated	No, fluazifop-butyl is no longer registered for use.
	Storage stability of residues in frozen soil samples	Required	41598004 40439401	Not classified - A storage stability study for fluazifop-butyl for 1.25 months was completed in connection with a terrestrial field dissipation study Not classified - Storage stability study supporting ground water monitoring study	No, fluazifop-butyl is no longer registered for use
835.1730	Bioconcentration in fish	Conditionally Required	93796 & 92067035 93795	Supplemental due to 45% of degradate in viscera not characterized. Not classified	No, the study showed minimal bioconcentration of total radioactivity which provides a conservative estimate of bioconcentration of fluazifop-p-butyl and fluazifop-p-acid.
	Spray droplet size spectrum (201-1) Spray drift field deposition (202-1)	Required. Data are available. May be satisfied through membership in the Spray Drift Task Force	No data	Not applicable	No, Syngenta Crop Protection, Inc. is a member of the Spray Drift Task Force[5]

1 List of Spray Drift Task Force Members available at http://www.agdrift.com/Text%20pages/members.htm (accessed March 28, 2008)

Unfulfilled effects data requirements are listed in Table 3 and Table 4:

- There are no chronic toxicity data available for the Agency to assess chronic risk of fluazifop-p-butyl to estuarine/ marine fish. However, an acute-to-chronic toxicity ratio (ACR)[4] was developed from existing freshwater fish data and used to extrapolate a chronic toxicity values for this taxa.

- No toxicity data have been submitted regarding the toxicity of fluazifop-p-butyl to terrestrial or aquatic plants. Risks to monocot plants are presumed due to the fact that fluazifop-p-butyl is a selective herbicide intended to control monocot plants. Risks to dicot aquatic plants are presumed to be minimal due to the fact that it is used routinely on dicot plant crops and no incidents of damage to these species have been reported. Risks to aquatic nonvascular and vascular plants and lichens are presumed in the absence of data.

- There are no data to evaluate the toxicity of degradate X for any plant or animal. In fate studies, degradate X made up to 37% of applied equivalents. If the toxicity of degradate X is presumed to be as toxic as the parent compound, increased risks to estuarine/marine invertebrates and and freshwater mollusks are expected. It is also possible that the endangered acute LOC for freshwater fish would be exceeded and acute risks to listed estuarine marine invertebrates will be greater for the proposed uses.

Table 3. Ecological Effects Data Requirements for Fluazifop-p-butyl

Guideline No.	Study Description	Species
850.4100 or 850.4225	Seedling Emergence (Tier I or Tier II, as appropriate*) – Formulation	Monocots: 4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4150 or 850.4250	Vegetative Vigor (Tier I or Tier II, as appropriate*) – Formulation	Monocots: (4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4100 or 850.4225	Seedling Emergence (Tier I or Tier II, as appropriate*) – Formulation	Monocots: 4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4400	Aquatic Plant Test using *Lemna* spp. (Tier I or Tier II as appropriate*) – Formulation	*Lemna gibba* or *Leman minor* (duckweed)

[4] Acute toxicity endpoint value ÷ Chronic toxicity endpoint value

Guideline No.	Study Description	Species
850.5400	Algal Toxicity Test (Tier I or Tier II as appropriate*) (Tier I) – Formulation	*Pseudokirchneriella subcapitata* (freshwater green alga); *Navicula pelliculosa* (freshwater diatom); and *Skeletonema costatum (marine diatom)*; *Anabaena flos-aquae* (freshwater cyanobacterium)

*A Tier II test (a definitive NOAEC and an IC_{25} for terrestrial plants or IC_{50} for aquatic plants) is appropriate unless at the highest application rate no effect will occur (*i.e.*, Tier I – limit test)

Table 4. Ecological Effects Data Requirements for Degredate-X.

Guideline No.	Data Requirement	Species
850.1035	Estuarine/Marine Invertebrate Acute Toxicity Test (Shrimp)	*Americamysis bahia* (mysid shrimp)
850.1055	Bivalve Acute Toxicity Test (Embryo-Larval)	*Crassostrea gigas* (Pacific Oyster), which was the most sensitive estuarine/marine invertebrate test and test species with the parent
850.1075	Freshwater Fish Acute Toxicity Test	Cold water species: *Oncorhynchus mykiss* (Rainbow Trout)
		Warm water species: *Lepomis macrochirus* (Bluegill Sunfish) or *Pimephales promelas* (Fathead minnow)
850.1300	Freshwater Aquatic Invertebrate Life-Cycle Toxicity Test	*Daphnia magna* (water flea)
850.1350	Marine Invertebrate Life-Cycle Toxicity Test	*Americamysis bahia* (mysid shrimp)
850.4150 or 850.4250	Vegetative Vigor (Tier I or Tier II as appropriate*)	Monocots: (4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4100 or 850.4225	Seedling Emergence (Tier I or Tier II, as appropriate*)	Monocots: 4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4400	Aquatic Plant Test using *Lemna* spp. (Tier I or Tier II as appropriate*) – Formulation	*Lemna gibba* or *Leman minor* (duckweed)
850.5400	Algal Toxicity Test (Tier I or Tier II as appropriate*) (Tier I) – Formulation	*Pseudokirchneriella subcapitata* (freshwater green alga); *Navicula pelliculosa* (freshwater diatom); and *Skeletonema costatum (marine diatom)*; *Anabaena flos-aquae* (freshwater cyanobacterium)

*A Tier II test (a definitive NOAEC and an IC_{25} for terrestrial plants or IC_{50} for aquatic plants) is appropriate unless at 40 percent of the highest application rate of the parent no effect will occur (*i.e.*, Tier I – limit test)

Labeling Recommendations

Based on the proposed uses, environmental fate and transport characteristics, and environmental toxicity endpoints for fluazifop-p-butyl and fluazifop-p acid, the following label advisories are recommended.

General Terrestrial Outdoor Uses

For terrestrial uses: Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater or rinsate.

Ground Water Advisory

Fluazifop-p-butyl is known to leach through soil into ground water under certain conditions as a result of label use. This chemical may leach into ground water if used in areas where soils are permeable, particularly where the water table is shallow

Surface Water Advisory

This product may impact surface water quality due to runoff of rain water. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having high potential for reaching surface water via runoff for several days to months or more after application. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of fluazifop-p-butyl from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur.

Environmental Hazards

This product is toxic to fish, other aquatic animals and may be toxic to aquatic plants. Do not apply directly to water, to areas where surface water is present, to intertidal areas below the mean high water mark ***or to areas where runoff into water bodies is expected****. Do not contaminate water when disposing of equipment washwaters. Do not apply when weather conditions favor drift from target areas.*

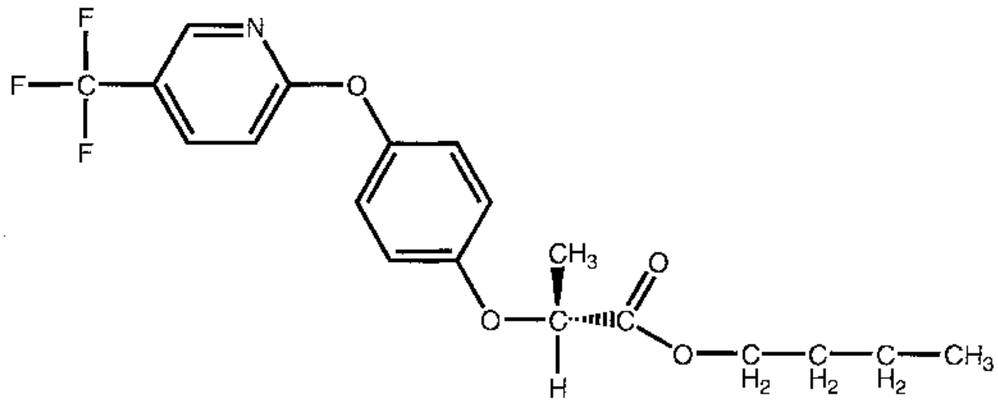
This product is toxic to grasses and other monocot plants. Minimize exposure to non target plants and do not apply when weather conditions favor drift from target areas.

11

ECOLOGICAL RISK ASSESSMENT

For The Proposed Registration of

FLUAZIFOP-P-BUTYL
FOR NEW USES ON DRY BEANS, PEANUTS, and SOYBEANS



FLUAZIFOP-P-BUTYL
CAS#: 79241-46-6
USEPA PC Code: 122809

End Use Products:	FUSILADE®DX (EPA Registration Number 100-1070)
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Table of Contents

List of Tables

List of Figures

1.0 Executive Summary

Syngenta Crop Protection, Inc. is seeking registration of fluazifop-p-butyl ((butyl (*R*)-2-{4-[5-(trifluoromethyl)-2-pyridyloxy]phenoxy}propionate; PC Code 122809; CAS Number 79241-46-6), and its end-use product Fusilade®DX (EPA Registration Number 100-1070; 24.5 % active ingredient (a.i.), flowable) for new uses on dry beans, peanuts, and pre and post-bloom uses on soybeans. This assessment addresses potential risk to plants and animals from the proposed new uses. Fluazifop-p-butyl is already registered for agricultural, commercial, and residential uses. It may be applied as a ground spray, aerial spray, and in irrigation systems. The proposed uses for dry beans and peanuts allow for a maximum single application of 0.38 lbs active ingredient per acre (a.i./A) and a maximum seasonal application rate of 0.75 lbs a.i./A. The minimum application interval is 14 days. For soybeans, the proposed application rates allow for a maximum single application rate of 0.38 lbs a.i./A prebloom and 0.09 lbs a.i./A between bloom to post-bloom (R1 growth stage or later) and a maximum seasonal application rate 0.47 lbs a.i./A. Soybeans may not be harvested for 60 days following the last application and cannot be grazed or harvested for forage or hay.

1.1 Nature of Chemical Stressor

A few different compounds are associated with the common name, fluazifop-butyl. Fluazifop-butyl (PC Code 122805) is the racemic mixture (*e.g.*, consists of equal amounts of the R and S enantiomers) of butyl-2-{4-[5-(trifluoromethyl)-2-pyridyloxy]phenoxy}propionate. Fluazifop-p-butyl (PC Code 122809) is the R enantiomer and is more herbicidally active than the S enantiomer (Tu *et al.* 2001). Both primarily degrade, via microbial mediated hydrolysis, in moist soil and sediments to fluazifop-acid which can also exist in the R or S form (MRID 162455; 87493, 92067033, 87492, 92067032, 46190602, 46190605).

Fluazifop-p-butyl is a selective post-emergent systemic aryloxyphenoxypropionic herbicide used to control perennial and annual grass weeds (Wood 2007). In general, it has little effect on broad-leaved plants (dicots) (Ware and Whitacre 2004). It is rapidly absorbed through leaf surfaces and hydrolyzes in the plant to fluazifop-acid, and then it is transported in phloem and accumulates in the meristems (Tu *et al.* 2001). The mode of action is via inhibition of CoA carboxylase, resulting in decreased lipid synthesis, especially at sites of active growth (Tu *et al.* 2001).

1.2 Potential Risks to Non-target Organisms

Risks were calculated for the application rates represented by the proposed label. The results of this assessment suggest that the proposed applications of fluazifop-p-butyl will result in direct risks to listed (threatened and endangered) and non-listed estuarine/marine invertebrates. The chronic risk to mammals exceeds the Agency's level of concern (LOC) for all scenarios and for birds in the proposed soybean application scenario. There are no explicit data regarding the toxicity of fluazifop-p-butyl to terrestrial plants. However, fluazifop-p-butyl at the proposed application rates is likely to pose risks to non-target terrestrial and aquatic monocot plants given that fluazifop-p-butyl is registered to control monocot plant species and that there are three reported incidents in EFED's Ecological Incident Information System (EIIS) database where crop damage was reported on corn, which is a monocot species. Although there are no acceptable data to assess the possible risks of fluazifop-p-butyl to dicot species, risks are presumed to be minimal due to the fact that fluazifop-p-butyl is an herbicide with a mode of action specific to monocot plants and is routinely applied to a variety of dicot plant crops at similar application rates and there are no reported incidents of damage to dicot plant species in the EIIS database for registered uses. There are no restrictions or advisories for dicot plant application on the current label for fluazifop-p-butyl. However, risks are presumed for aquatic plants, algae and lichens due to the lack of toxicity data for these species.

Risks to Terrestrial Species

No acute risks are expected for mammals or birds or terrestrial-phase amphibians and reptiles from the proposed new uses of fluazifop-p-butyl. Acute risk quotients did not exceed the Agency's acute endangered LOC for terrestrial invertebrates, mammals or birds for any of the proposed uses of fluazifop-p-butyl. However, the chronic mammalian RQ values exceed the Agency's LOC for all proposed uses except for mammals feeding only on fruits, pods, large insects or seeds.

Except for one algal test, there are no acceptable data regarding the toxicity of fluazifop-p-butyl to aquatic or terrestrial plants. Regarding terrestrial plants given that fluazifop-p-butyl is an herbicide with a mode of action specific to monocot plants and that it is registered for use on many dicot plant crops without any verified incidents resulting from registered uses reported in the EIIS database, it is reasonable to assume that risks to terrestrial dicot plants is minimal. There are no advisories or restrictions for use of fluazifop-p-butyl listed on current approved labels. However, risks to aquatic and terrestrial monocot plants are presumed due to the fact that fluazifop-p-butyl is a selective herbicide intended to control monocot plants. Risks to listed aquatic vascular plants, algae and lichens are presumed in the absence of data.

- The Agency's acute endangered LOC was not exceeded for listed terrestrial invertebrates, avian or mammalian species.
- The Agency's LOC is exceeded for chronic risks to non-listed and listed mammals for all proposed applications.
- Risks to non-listed and listed monocot terrestrial and semi-aquatic plants, ferns, cycads, lichens are presumed in the absence of data.

Risks to aquatic species

There are no data to evaluate the toxicity of degradate X for any plant or animal. In fate studies, degradate X made up to 37% of applied equivalents. If the toxicity of degradate X is presumed to be as toxic as the parent compound, increased risks to estuarine/marine invertebrates and freshwater mollusks are expected. It is also possible that the acute and chronic LOC's for freshwater fish will be exceeded and that the endangered LOC will be exceeded even more for estuarine marine invertebrates for the proposed uses.

The results of this assessment suggest that the proposed applications of fluazifop-p-butyl will result in direct risks to federally listed estuarine/marine invertebrates and freshwater mollusks and potentially non-crustacean invertebrate taxa and acute risks to non-listed species. There are no acceptable data to determine chronic risks to estuarine/marine fish. However, an Acute to

Chronic (ACR) ratio method was employed to derive chronic values for this taxa. The chronic LOC was not exceeded for any scenario. Risks to aquatic plants are presumed due to the fact that fluazifop-p-butyl is a plant toxicant.

- The acute estuarine/marine invertebrate RQ values and freshwater mollusk RQ values exceed the Agency's LOC for listed species for all proposed applications except the WA dry bean scenarios and the acute restricted LOC for non-listed species.
- Chronic RQ values for fish and invertebrates do not exceed for any scenario.
- Risks to listed and non-listed aquatic monocot plants are presumed in the absence of data and because fluazifop-p-butyl is a selective herbicide intended to control monocot plants.
- Risks to vascular and non-vascular aquatic plants are presumed in the absence of data.

Table 1-1. Potential Risks to Nonlisted and Listed Species Associated with Direct or Indirect Effects from the Proposed Application of Fluazifop-p-butyl on Peanuts, Dry Beans and Soybeans[1]

Taxonomic Group	Effects Endpoint	Direct Effects		Indirect Effects to Listed Species	
		Non-listed	Listed	Potential	Indirect Effects Due to Direct Effect to:[2]
Aquatic plants	No data available	Yes, presumed as it is a plant toxicant and there is no toxicity data supporting levels reaching the aquatic system are below levels of concern		Yes	Terrestrial and semi-aquatic plants
Dicot semi-aquatic and terrestrial plants	No data available	No, Fluazifop-p-butyl is routinely applied to a variety of dicot plant crops at similar application rates and there are no reported incidents of damage to dicot plant species in the EIIS database for registered uses.		Yes	Monocot terrestrial plants, mammals
Monocot semi-aquatic and terrestrial plants	No data available	Yes, fluazifop-p-butyl is registered to control monocot plant species and there are reported incidents showing crop damage to corn, a monocot species		Yes	Mammals
Freshwater fish and amphibians	Acute: mortality Chronic: early-life stage NOAEC	Acute: No Chronic:No	Acute: No Chronic: No	Yes	Algae, aquatic plants, terrestrial and semi-aquatic plants, and aquatic freshwater invertebrates
Freshwater invertebrates	Acute: mortality* Chronic: life cycle NOAEC	Acute: Yes Chronic: No	Acute: Yes Chronic: No	Yes	Monocot terrestrial and aquatic plants
Estuarine/ Marine fish	Acute: mortality Chronic: Extrapolated early life stage NOAEC	Acute: No Chronic: No	Acute: No Chronic: No	Yes	Monocot terrestrial and aquatic plants, estuarine/marine invertebrates
Estuarine/ Marine Invertebrates	Acute: mortality* Chronic: No data, used ACR from freshwater invertebrates	Acute: Yes Chronic: No	Acute: Yes Chronic: No	Yes	Monocot terrestrial plants, aquatic plants

Taxonomic Group	Effects Endpoint	Direct Effects		Indirect Effects to Listed Species	
		Non-listed	Listed	Potential	Indirect Effects Due to Direct Effect to:[2]
Mammals	Acute oral dose: mortality Chronic: mortality and reproduction	Acute: No Chronic: Yes	Acute: No Chronic: Yes	Yes	Terrestrial plants, freshwater and estuarine/marine organisms
Birds	Acute oral dose: mortality Chronic: mortality and reproduction	Acute: No Chronic: Yes**	Acute: No Chronic: Yes**	Yes	Terrestrial plants, mammals, freshwater and estuarine/marine organisms
Terrestrial invertebrates	Acute contact: mortality	Acute: No	Acute: No	Yes	Terrestrial plants

*For mollusks embryo/larval survival and normal shell development.
**Where diet is composed primarily of short grass.
[1]Abbreviations: ACR = acute to chronic ratio; LOAEC= lowest observed effects concentration
[2] Direct effects to species may result in indirect effects to other species by changing availability of prey, habitat, and other factors important to survival and reproduction.

1.3 Conclusions – Exposure Characterization

Fluazifop-p-butyl

The new proposed use of fluazifop-p-butyl may result in drift onto plants, soil, or water adjacent to a treated field. In most use scenarios, fluazifop-p-butyl will undergo aerobic degradation to fluazifop-acid within hours to < 2 days, especially in moist soils and aerobic aquatic systems (MRID 87493, 92067033, 87492,162455, 46190605; Smith 1987). However, fluazifop-butyl is more stable under drier conditions with half-lives measured as high as 17 days (Negre *et al.* 1988; Smith 1987). Abiotic degradation of fluazifop-butyl was slower than biotic degradation. Hydrolysis rates for fluazifop-butyl and fluazifop-p-butyl decreased with pH and ranged from 0.2 to 2.5 days at pH 9, 78 days to stable at pH 7, and both were stable at pH 4 and 5 (Table 3-1). Fluazifop-butyl was shown to be stable to photolysis in water and soil (MRID 93788, 93789). Terrestrial field dissipation studies indicate that fluazifop-butyl and fluazifop-p-butyl have the potential to remain in soil for days to weeks. Contrary to the laboratory studies that showed degradation of fluazifop-butyl within hours to days, when fluazifop-butyl is applied in the field it could take more than 4 weeks for most of the pesticide to dissipate.

No acceptable studies on sorption of fluazifop-p-butyl and fluazifop-butyl have been submitted. Based on the log octanol-water partition coefficient (K_{OW}) of > 5.3, terrestrial field dissipations studies, and laboratory degradation studies it is not expected to be highly mobile and move into ground water or surface water (MRID 47272601; 41598004); however, this cannot be ruled at as it has been detected in ground water and surface water at low concentrations, see Section 3.2.1.4 on monitoring. The detections in ground water and surface water in monitoring studies suggest that (a) the surrogate indicators are not adequate to predict fluazifop-butyl mobility and/or (b) under certain conditions, fluazifop-butyl may be more persistent and mobile than predicted from laboratory studies. This is also supported by the results seen in the terrestrial field dissipation studies.

The vapor pressure of fluazifop-p-butyl (0.03 – 0.23 mPa) indicates it is borderline between semi-volatile and non-volatile.[1] We cannot rule out volatization under some conditions because fluazifop-butyl has been detected in low concentrations (< method detection limit of 0.14 ng/100m^3 – 0.07 ng/m^3) in air in an agricultural area (White *et al.* 2006).

Fluazifop-Acid

The primary degradation pathway of fluazifop-p-acid is also via microbially mediated hydrolysis and half-lives ranged from 6 - >168 days in aerobic soils and aerobic aquatic environments (Table 3-1). Anaerobic degradation was slower with half-lives ranging from 289 – 1155 days. Fluazifop-acid and fluazifop-p-acid were stable to hydrolysis in water (Negre *et al.* 1988; MRID 46190601). Photolysis studies were not conducted for fluazifop-p-acid. Fluazifop-p-acid is a weak acid and will be present predominantly in the anionic form at environmental pH values.

Fluazifop-p-acid is expected to be highly mobile and has the potential to reach ground water and surface water. Soil-water distribution coefficients (K_d) values for fluazifop-acid and fluazifop-p-acid ranged from 0.14 – 13.4 and Freundlich sorption coefficient (K_F) values ranged from 0.14 to 38.5 L/kg. Organic-carbon-water partition coefficient (K_{OC}) values ranged from 8.9 to 310.8 L/kg and (Organic-carbon normalized Freundlich sorption coefficient (K_{FOC}) values ranged from 8.3 to 83.6 L/kg. Coefficients of variation were lower for K_F values (1%) than for K_{FOC} values (57%) and sorption was nonlinear indicating that sorption was dependent on the equilibrium concentration in water.[2] In terrestrial field dissipation studies, fluazifop-acid was found in 6-12 inch and 30-36 inch soil depths (MRID 41598004), indicating that this compound is mobile.

The estimated vapor pressure of fluazifop-p-acid and fluazifop-acid (0.037 mPa) indicate they are non-volatile (based on criteria in Corbin *et al.* 2006); however, volatization cannot be ruled out because the vapor pressure is estimated.

Degradates

Degradates observed in environmental fate studies near or greater than 10% of applied cumyluron equivalents include:

- 2R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid (fluazifop-p-acid)
- 2-hydroxy-5-trifluoromethylpyridine (degradate X), and
- 2-(4-hydroxyphenoxy)-5-trifluoromethylpyridine (degradate IV).

Fluazifop-p-acid, degradate X, and degradate IV were found at maximums of 98%, 37%, and 9.9% of applied equivalents, respectively. Fluazifop-acid and degradate X are the primary metabolites to which organisms may be exposed. The structure of degradate X is different from the parent compound and fluazifop-acid and the toxicity and environmental fate would not be well predicted from values based on the parent and fluazifop-acid. Environmental fate data are

[1] Fluazifop-butyl is considered non-volatile based on criteria described in Corbin *et al.* 2006; however, pesticides with vapor pressures of 0.83 and 0.024 mPa, near the vapor pressure of fluazifop-butyl, have been found in remote environments, indicating that they underwent atmospheric transport and are semi-volatile (Daly *et al.* 2007; Gouin *et al.* 2004).

[2] Freundlich exponents, 1/n, ranged from 0.5 to 0.78 when reported.

not available to estimate exposure to degradate X in the aquatic environment and this is an uncertainty in the risk assessment.

1.4 Conclusions – Effects Characterization

Estuarine/marine invertebrates are the most sensitive aquatic species. Fluazifop-p-butyl is highly acutely toxic to the Pacific Oyster (*Crassostrea gigas*), with a 48-hEC_{50} value of 0.083 mg acid equivalents (ae)/L. Fluazifop-p-butyl is very highly toxic to freshwater fish, with a reported 96-h LC_{50} value of 0.32 mg ae/L to the Fathead minnow (*Pimephales promelas*). Fluazifop-p-butyl is also very highly toxic to freshwater invertebrates and estuarine/marine fish with a reported 48-h EC_{50} value of 5.14 μg ae/L to the Water Flea (*Daphnia magna*), and a reported 96-h LC_{50} of 6.86 mg ae/L to the Sheepshead Minnow (*Cyprinodon variegatus*) respectively.

Chronic exposure studies identified a freshwater invertebrate 21-d NOAEC value of 0.0854 mg ae/L for *D. magna* , a mysid (*Americamysis bahia*) 28-d reproduction NOAEC of 0.0148 mg ae/L and a freshwater fish 30-d NOAEC value of ≥0.203 mg ae/L for the Fathead Minnow (*Pimephales promelas*). The fathead minnow NOAEC value was less sensitive than the invertebrates. Acceptable chronic toxicity data for estuarine/marine fish have not been submitted to the Agency. However, an ACR value calculated for the freshwater fish *P. promelas* of 1.6[1] was used to extrapolate an early life stage NOAEC of ≥4.3 mg ae/L from the acute 96-h LC_{50} value available for *C. variegatus*.

In birds, the acute oral LD_{50} for *Anas platyrhynchos* is >5,000 mg/kg-bw and the 8-d avian dietary LC_{50} value for *Phasianus colchicus* is 20,767 ppm, both considered practically nontoxic. The avian reproductive toxicity NOAEL for a *Colinus virginianus* and a *Anas platyrhynchos* study are both ≥50 ppm. In laboratory rats, fluazifop-p-butyl has a dose based acute toxicity LD_{50} value of 1940 mg/kg-bw and a 2-generation reproductive NOAEL value of 0.74 ppm. Fluazifop-p-butyl is practically non-toxic to the Honey Bee with an acute contact LD_{50} of 63 μg/bee.

No toxicity data have been submitted regarding the toxicity of fluazifop-p-butyl to terrestrial plants. Risks to monocot terrestrial and semi-aquatic plants are presumed due to the fact that fluazifop-p-butyl is a selective herbicide intended to control monocot plants. Risks to dicot terrestrial plants are presumed to be minimal due to the fact that it is used routinely on dicot plant crops and no incidents of damage to these species have been reported. Risks to aquatic vascular and non-vascular plants and lichens are presumed in the absence of data.

There are no data to evaluate the toxicity of degradate X for any plant or animal. In fate studies, degradate X made up to 37% of applied equivalents. If the toxicity of degradate X is presumed to be as toxic as the parent compound, increased risks to estuarine/marine invertebrates are expected. It is also possible that the acute and chronic LOC's for freshwater fish, estuarine/marine fish, freshwater invertebrates, estuarine marine invertebrates and aquatic plants will be exceeded for the proposed uses.

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[1]Fish ACR = *P. promelas* 96-h LC_{50}/ *P. promelas* early-life stage NOAEC = 0.32 ppm ae/≥0.203 ppm ae = ≤1.6; estimated *C. variegatus* NOAEC = *C. variegatus* 96-h LC_{50}/fish ACR = 6.86/≤1.6 = ≥4.3 ppm ae.

1.5 Key Uncertainties and Data Gaps

Effects Data Gaps

Effects data gaps are summarized in Table 1-2 and Table 1-3.

- No acceptable data were submitted for chronic toxicity to estuarine/marine fish. An ACR value was obtained from the freshwater animal studies and applied to the acute toxicity data for estuarine/marine species to derive chronic toxicity values. This approach yielded a NOAEC value of $\geq$4.3 mg ae/L for the estuarine/marine fish *C. variegates*.

- No toxicity data have been submitted regarding the toxicity of fluazifop-p-butyl to terrestrial plants. Risks to monocot plants are presumed due to the fact that fluazifop-p-butyl is a selective herbicide intended to control monocot plants. Risks to dicot plants are presumed to be minimal due to the fact that it is used routinely on dicot plant crops and no incidents of damage to these species have been reported. Risks to algae and lichens are presumed in the absence of data.

- There are no data to evaluate the toxicity of degradate X for any plant or animal. In fate studies, degradate X made up to 37% of applied equivalents. If the toxicity of degradate X is presumed to be as toxic as the parent compound, increased risks to estuarine/marine invertebrates are expected. It is also possible that the acute and chronic LOC's for freshwater fish, estuarine/marine fish, freshwater invertebrates, estuarine marine invertebrates and aquatic plants will be exceeded for the proposed uses. Toxicity data for the acute and chronic effects of degradate X to freshwater fish and freshwater and estuarine/marine invertebrates, and aquatic plants are needed to assess these risks.

Table 1-2. Ecological Effects Data Requirements for Fluazifop-p-butyl

Guideline No.	Study Description	Species
850.4100 or 850.4225	Seedling Emergence (Tier I or Tier II, as appropriate*) – Formulation	Monocots: 4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4150 or 850.4250	Vegetative Vigor (Tier I or Tier II, as appropriate*) – Formulation	Monocots: (4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4100 or 850.4225	Seedling Emergence (Tier I or Tier II, as appropriate*) – Formulation	Monocots: 4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4400	Aquatic Plant Test using *Lemna* spp. (Tier I or Tier II as appropriate*) – Formulation	*Lemna gibba* or *Leman minor* (duckweed)

Guideline No.	Study Description	Species
850.5400	Algal Toxicity Test (Tier I or Tier II as appropriate*) (Tier I) – Formulation	*Pseudokirchneriella subcapitata* (freshwater green alga); *Navicula pelliculosa* (freshwater diatom); and *Skeletonema costatum (marine diatom)*; *Anabaena flos-aquae* (freshwater cyanobacterium)

Table 1-3. Ecological Effects Data Requirements for Degradate-X.

Guideline No.	Data Requirement	Species
850.1035	Estuarine/Marine Invertebrate Acute Toxicity Test (Shrimp)	*Americamysis bahia* (mysid shrimp)
850.1055	Bivalve Acute Toxicity Test (Embryo-Larval)	*Crassostrea gigas* (Pacific Oyster), which was the most sensitive estuarine/marine invertebrate test and test species with the parent
850.1075	Freshwater Fish Acute Toxicity Test	Cold water species: *Oncorhynchus mykiss* (Rainbow Trout)
		Warm water species: *Lepomis macrochirus* (Bluegill Sunfish) or *Pimephales promelas* (Fathead minnow)
850.1300	Freshwater Aquatic Invertebrate Life-Cycle Toxicity Test	*Daphnia magna* (water flea)
850.1350	Marine Invertebrate Life-Cycle Toxicity Test	*Americamysis bahia* (mysid shrimp)
850.4150 or 850.4250	Vegetative Vigor (Tier I or Tier II as appropriate*)	Monocots: (4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4100 or 850.4225	Seedling Emergence (Tier I or Tier II, as appropriate*)	Monocots: 4 species of at least two families, one species of which is corn (*Zea mays*) Dicots: Six species of at least four families, one species of which is soybean (*Glycine max*) and a second which is a root crop
850.4400	Aquatic Plant Test using *Lemna* spp. (Tier I or Tier II as appropriate*) – Formulation	*Lemna gibba* or *Leman minor* (duckweed)
850.5400	Algal Toxicity Test (Tier I or Tier II as appropriate*) (Tier I) – Formulation	*Pseudokirchneriella subcapitata* (freshwater green alga); *Navicula pelliculosa* (freshwater diatom); and *Skeletonema costatum (marine diatom)*; *Anabaena flos-aquae* (freshwater cyanobacterium)

Fate Data Gaps

- No data were submitted on the photodegradation of fluazifop-p-acid in soil or water systems. Therefore, fluazifop-p-acid is assumed to be stable under these conditions. This uncertainty may result in high exposure estimates for fluazifop-p-acid in certain soil conditions and low exposure estimates for its degradates. Photodegradation studies in soil and water are being requested because degradation products that were not present in other studies may be present in the photodegradation studies and these are an important data input for modeling surface water EECs.

- Studies supporting the water solubility, vapor pressure, and Henry's law constant of fluazifop-acid have not been submitted. The vapor pressure and Henry's law constant are values that were estimated using EPI-Suite V3.12 and the water solubility was reported by the registrant. These values are important in estimating the surface water EECs. Uncertainties associated with each of these individual components add to the overall uncertainty of the modeled concentrations.

- The laboratory degradation data and field dissipation studies are somewhat contradictory. Laboratory studies, which provide input data for modeling, showed that fluazifop-butyl would only be present for hours to <2 days (Table 3-1). Chemicals with half-lives this short are typically not modeled because the chemical is not present long enough for transport to surface waters to occur. In this assessment, it was assumed that all of the applied chemical was fluazifop-acid and exposure would primarily be to fluazifop-acid. This is a conservative estimate of exposure because 1) under most conditions, the butyl will transform into the acid quickly and 2) fluazifop-butyl and fluazifop-acid are expected to have similar toxicities and so estimating exposure to the acid should also cover exposure to the butyl. However, terrestrial field dissipations studies do indicate that fluazifop-butyl may be present for days to weeks and monitoring studies found residues of fluazifop-butyl in surface water and ground water. This should not significantly influence the conclusions of this risk assessment unless the toxicity one compound is found to be substantially more toxic than the other. Given the similar structures and the metabolism of the butyl to the acid in organisms, this is unlikely.

- Degradate X, made up to 37% of applied equivalents in environmental fate studies; however, environmental fate data are not sufficient to estimate surface water EECs and toxicity data are not available to evaluate degradate X's toxicity. Exposure to degradate X is expected to be lower than exposure to fluazifop-butyl and fluazifop-acid.

- The vapor pressure of fluazifop-butyl (0.12-0.23 mPa) and fluazifop-acid (estimated to be 0.037 mPa) indicate they are borderline between semi-volatile and non-volatile. For example, pesticides with vapor pressures of 0.83 and 0.024 mPa have been found in remote environments, indicating that they underwent atmospheric transport and are semi-volatile (Daly *et al.* 2007; Gouin *et al.* 2004). Additionally, available monitoring indicate that, at least under some conditions, fluazifop-butyl might be found in low concentrations in the air and move via atmospheric transport (White *et al.* 2006). Some transport through the air may occur for fluazifop-butyl and fluazifop-acid. Currently, tools are not available to evaluate long range transport or exposure to semi-volatile compounds.

2.0 Problem Formulation

The purpose of this problem formulation is to provide the foundation for the ecological risk assessment being conducted for fluazifop-p-butyl. As such, it articulates the purpose and objectives of the risk assessment, evaluates the nature of the problem, and provides a plan for analyzing the data and characterizing the risk (EPA 1998).

2.1 Nature of Regulatory Action

The regulatory action reviewed in this risk assessment is a proposed national (Section 3 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)) registration for the new use of fluazifop-p-butyl, as a post-emergent herbicide to control perennial and annual grass weeds on dry beans, peanuts, and soybeans. FIFRA requires that registered pesticides do not pose unreasonable adverse effects to the environment, and the Endangered Species Act requires that regulatory actions are not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat.[1] The purpose of this assessment is to provide insight into the potential effects to the environment associated with the use of fluazifop-p-butyl as proposed on the product label and to provide supporting information for the registration decision.

The proposed end-use product is Fusilade®DX (EPA Registration Number 100-1070; 24.5 % a.i., flowable) manufactured by Syngenta Crop Protection Inc. for use as a post-emergent herbicide to control perennial and annual grass weeds on dry beans, peanuts, and soybeans. It may be applied as a ground spray, aerial spray, and in irrigation systems. The proposed uses for dry beans and peanuts allow for a maximum single application of 0.38 lbs a.i./A and a maximum seasonal application rate of 0.75 lbs a.i./A. The minimum application interval is 14 days for dry beans and peanuts. For soybeans, the proposed application rates allow for a maximum single application rate of 0.38 lbs a.i./A prebloom and 0.09 lbs a.i./A between bloom to post-bloom (R1 growth stage or later) and a maximum seasonal application rate 0.47 lbs a.i./A.

2.2 Stressor Source and Distribution

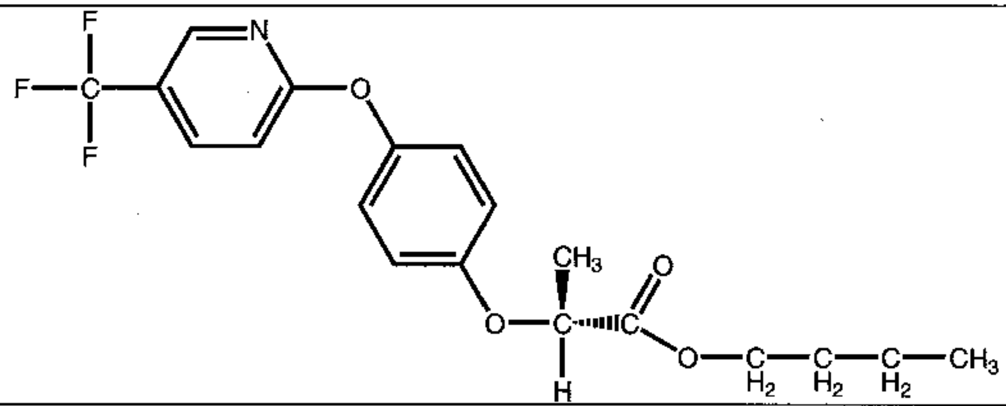
2.2.1 Chemical Identity and Mode of Action

Butyl (*R*)-2-{4-[5-(trifluoromethyl)-2-pyridyloxy]phenoxy}propionate (common name fluazifop-p-butyl) is an aryloxphenoxypropionic (formerly oxyphenoxy acid esters) class herbicide (Wood 2007; Ware and Whitacre 2007). The mode of action is to inhibit lipid synthesis resulting in the disruption of cell walls (Tu *et al.* 2001). Table 2-1 summarizes the identity information associated with fluazifop-p-butyl.

Table 2-1. Chemical Identification for the Active Ingredient Fluazifop-p-butyl

Common Name:	Fluazifop-p-butyl
Pesticide Class:	aryloxphenoxypropionic herbicide

[1] Section 7(a)(2) of the Endangered Species Act.

EPA PC Code:	122809
IUPAC Name:	butyl (*R*)-2-{4-[5-(trifluoromethyl)-2-pyridyloxy]phenoxy}propionate
CAS Name:	butyl (2*R*)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoate
CAS No:	79241-46-6
Synonyms:	fluazifop-P butyl ester; fluazifop-r-butyl; Fusilade 2000; Fusilade DX; Fusilade S; Fusilade super; PP 005; Propanoic acid, 2-(4-((5-(trifluoromethyl)-2-pyridinyl)oxy)phenoxy)-, butyl ester, (R)-
Smiles String:	n1cc(C(F)(F)F)ccc1Oc2ccc(OC(C)C(=O)OCCCC)cc2 (EPI Suite v3.12 SMILES string from ISIS .MOL)
Structure:	

Enantiomer Considerations for Fluazifop-p-butyl

A few different compounds are associated with the common name, fluazifop-butyl. Fluazifop-butyl (PC Code 122805) is the racemic mixture (*e.g.*, consists of equal amounts of the R and S enantiomers) of butyl-2-{4-[5-(trifluoromethyl)-2-pyridyloxy]phenoxy}propionate. Fluazifop-p-butyl (PC Code 122809) is the R enantiomer and is more herbicidally active than the S enantiomer (Tu *et al.* 2001). Both degrade, via microbial mediated hydrolysis, in moist soil and sediments to the fluazifop-acid which can also exist in the R or S form (MRID 162455; 87493, 92067033, 87492, 92067032, 46190602, 46190605). The chemical structures and names are shown in Table A 1, in Appendix A.

The Special Review and Reregistration Division (SRRD)[1] and the former Ecological Effects Division[2] (now the Environmental Fate and Effects Division (EFED)) indicated that the data requirements for the two active ingredients should be considered separately. This approach is supported by reports that different enantiomers of the same chemical can have different biological activities, *e.g.*, toxicities (Xu *et al.* 2008).[3] In the same memo (1991), the environmental fate review indicated that data for fluazifop-butyl would be acceptable to fulfill

[1] Transmittal of EFED list B Review of Fluazifop-butyl and fluazifop-p-butyl (Case # 2285; Chemical #, 122805, 122809; Memo from A. Rispin dated March 4, 1991).
[2] Letter from the Registration Division (RD) to ICI Americas, Inc. dated May 4, 1984.
[3] The differing toxicity of the enantiomers is also illustrated by the differences in the effectiveness of the different enantiomers as herbicides.

the environmental fate requirements of fluazifop-p-butyl, unless evidence indicated that the environmental fate would be different for the different enantiomers.

Enantiomers have been studied for fluazifop-butyl and related compounds in three British soils and in a mixed microbial population. Conversion of the S acid to the R acid was reported in the three British soils (Bewick 1986). The R:S enantiomer ratio of fluazifop-acid in two soils was approximately 82:18 at two days after application of fluazifop-butyl, and ranged from 93:7 to 95:5 from 3 to 12 weeks after application; however, in a third loamy sand soil, the R:S ratio was 64:37 at 3 weeks after application of fluazifop-butyl and was 92:8 at 12 weeks (MRID 87493, 92067032, 162455). When the S-enantiomer of fluazifop-butyl was applied to a sandy loam soil (British classification), it was hydrolyzed to fluazifop-acid which gradually changed to 98% present in the R form over 7 days (MRID 162455). Negre *et al.* (1993) reported that the S-enantiomer of fluazifop-acid was degraded at a much faster rate than the R-enantiomer by a mixed microbial culture, and indicated that the change in the ratios was not a result of the conversion of the S form to the R form but a result of different rates of degradation. This was supported by showing that two different rates of degradation existed. Enantioselective degradation and enantiomer interconversions were also reported for chiral phenoxyalkanoic acid herbicides with selective conversion to or enrichment of the R enantiomer (Muller and Buser 1997). Stereoselective metabolism and enantiomer interconversions often depend on the microbial species present and more information is needed to predict the behavior of the enantiomers in the natural environment (Muller and Buser 1997; Polarco *et al.* 1999; Qin *et al.* 2006). For example, preferential degradation of the S isomer of dichlorprop and mecoprop was observed in soil and different stereoselectivity may occur in different media (Wang *et al.* 2005; Qin *et al.* 2006). Finally, some compounds have been shown to undergo enantiomerization in polar solvents, alcohols, and water and it is possible that fluazifop-p-butyl and fluazifop-p-acid may racemize, *e.g.*, form equal amounts of the R and S enantiomers, in water (Qin and Gan 2007; Lee 1989).

These studies suggest that information on the R enantiomer should be adequate as fluazifop-p-acid is expected to be applied to soils and the S form is either degraded faster or converted to the R form in soil. However, we do not know how fluazifop-p-acid will behave in soils with a range of different microbial populations or in water. Due to these data gaps, exposure may be viewed as the exposure to total toxic residues of fluazifop-acid, with assumptions that fluazifop-acid may be present in the R or S form or as a mixture of the enantiomers. More information on the behavior of specific enantiomers in water or American soils would reduce the uncertainty on which enantiomer will predominate in the environment. The racemic mixture and R forms are reviewed together here as the environmental fate of both forms is relevant to the environmental fate assessment.

2.2.2 Physico-chemical Properties of Fluazifop-p-butyl and Related Compounds

Physical and chemical properties can be used to identify a *priori* the potential behavior of a chemical in the environment. Fluazifop-p-butyl has a vapor pressure of 0.12 mPa at 20°C and 0.23 mPa at 25°C and Henry's law constants ranging from 0.0063 to 0.049 Pa-m^3/mole, indicating it is not likely to volatize substantially at environmental temperatures (MRID 47272601; based on criteria in Corbin *et al.* 2006). It is slightly soluble with a water solubility of 0.93 mg/L (MRID 47272601) and has a moderate log K_{OW} ranging from 4.5 at 20°C to > 5.3 at

25°C, indicating that it has a higher affinity for organics than for water (MRID 47272601; US EPA 2004) and has the potential to accumulate in organisms. Table 2-2 provides a summary of the physico-chemical properties of fluazifop-p-butyl and related compounds.

Fluazifop-acid and fluazifop-p-acid are weak acids with pKa's estimated between 2.7 and 3.12. At typical environmental pHs, fluazifop-acid is mainly in anionic form (assuming a pKa of 3.12, 88% is ionized at pH 4, 98% ionized at pH 5, and greater than 99% ionized at pH 5.5 and higher). It is highly soluble in water with a water solubility of 780 mg/L, pH not reported (based on criteria in FAO 2000). The log K_{OW} is 3.18 and it is expected to have a higher affinity for organics and lower solubility in its neutral form, *e.g.*, at lower pH.

Finally, the estimated vapor pressure of fluazifop-acid indicates it is borderline between semi-volatile and non-volatile.[1] While we expect volatility to be low for both fluazifop-acid and fluazifop-butyl, we cannot rule out volatization under some conditions because fluazifop-butyl has been detected in air in an agricultural area (White *et al.* 2006) and the vapor pressure of fluazifop-acid is estimated. Fluazifop-p-butyl was detected at low concentrations (0.02-0.07 ng/m^3) in air at two potato farm sites in Prince Edward Island, Canada (White *et al.* 2006). The authors noted that these were among the first reported detections of fluazifop-p butyl in air. The Agency is not aware of any other studies that have found either fluazifop butyl or acid in the air.

Table 2-2. Summary of Physico-Chemical Properties of Fluazifop-butyl and related Compounds[1].

Property	Fluazifop-p-butyl	Fluazifop-butyl	Fluazifop-p-acid
Empirical Formula	$C_{19}H_{20}F_3NO_4$	$C_{19}H_{20}F_3NO_4$	$C_{15}H_{12}F_3NO_4$
Molecular weight (g/mole)	383.37[2]	383.37	327.26
Melting Point (°C)	-46[3] 5[4]	13[4]	
Boiling Point (°C)	**Thermal decomposition begins at 100°C[5]** 164.5[2] 164[4]	165 at 0.02 mmHg[4]	
Density (g/mL; g/cc; or g/cm^3)	**1.22 (PAI)[5]** **1.20 at 20 °C (TGAI)[5]**	1.21[6]	
Dissociation Constant, pKa	**No pKa between pH 1 and 12.0[5]**		3.12[10] 2.7[11]
Vapor Pressure (mPa)	**0.12 at 20°C[5]** **0.23 at 25°C[5]** 0.12 at 25°C[3]	0.055 at 20°C[8]	
Henry's Law Constant ($Pa\text{-}m^3/mole$)	**0.049 (estimated)[5]**	0.018 at 20°C[4] 0.0211 at 25°C[7]	0.037 (estimated)[10]

[1] Fluazifop-acid is considered non-volatile based on criteria described in Corbin *et al.* 2006; however, pesticides with vapor pressures of 0.83 and 0.024 mPa, near the estimated vapor pressure of fluazifop-acid, have been found in remote environments, indicating that they underwent atmospheric transport and are semi-volatile (Daly *et al.* 2007; Gouin *et al.* 2004).

Property	Fluazifop-p-butyl	Fluazifop-butyl	Fluazifop-p-acid
Water Solubility (mg/L)	**0.93[5]**	1 at pH 6.5[8] 2[9] 1[3]	5.1×10^{-6} (estimated)[10]
Solvent Solubility	Soluble in most organic solvents >500 g/L in acetone, dichloromethane, ethyl acetate, hexane, methanol, toluene, and xylene[2]	2.4×10^4 in propylene glycol[4]	40.5 at 20°C (estimated) 780 at 20°C[12]
Log K_{OW}	**>5.3 at 25°C[5]** 4.5 at 20°C[2,3]	4.5[4]	3.18[10]

1 Data that were not submitted in an MRID product chemistry study are not primary sources and in general, these data are not used in modeling. However, physico-chemical properties are sometimes used when no primary data are available or better information is available from other sources. Primary data are shown in bold.
2 Data from TRED Case No. 2285 completed on August 11, 2004.
3 Data from EU Regulatory / Evaluation Data / EU Annex III PIC DGD as reported from the FOOTPRINT database available at: http://sitem.herts.ac.uk/aeru/footprint/en/ (accessed August 22, 2008). This data is considered to have a high quality.
4 Pesticide Manual, 10th Ed., British Crop Protection Council, and the Royal Society of Chemistry, 1994. as reported in the Agricultural Research Service (ARS) handbook available at: http://www.ars.usda.gov/Services/docs.htm?docid=14199 (accessed August 22, 2008). This data source is considered to have a medium quality.
5 Data from MRID 47272601 and are provisional values pending complete review of the study.
6 Data from EU Regulatory / Evaluation Data / EU Annex III PIC DGD as reported from the FOOTPRINT database available at: http://sitem.herts.ac.uk/aeru/footprint/en/ (accessed August 22, 2008). This data is considered to have a high quality.
7 Data from Pesticide manuals and hard copy reference books as reported from the FOOTPRINT database available at: http://sitem.herts.ac.uk/aeru/footprint/en/ (accessed August 22, 2008). The quality of this data is unknown.
8 Pesticide Manual, 9th Ed., British Crop Protection Council, 1991 as reported in the Agricultural Research Service (ARS) handbook available at: http://www.ars.usda.gov/Services/docs.htm?docid=14199 (accessed August 22, 2008). This data source is considered to have a medium quality.
9 Agrochemicals Handbook, 2nd Edition, RSC, Nottingham, UK. 1987 as reported in the Agricultural Research Service (ARS) handbook available at: http://www.ars.usda.gov/Services/docs.htm?docid=14199 (accessed August 22, 2008). This data source is considered to have a medium quality.
10 Data from National Library of Medicine, ChemIDplus, available at http://chem.sis.nlm.nih.gov/chemidplus/chemidlite.jsp (accessed August 22, 2008). Value is reported for racemic fluazifop-acid. This data source is considered to have a medium quality.
11 An environmental fate summary (From Will Garner 03/24/1982) reported that the pKa of fluazifop-acid was 2.7.
12 Reported by registrant in metabolism study, see MRID 46190602.

2.2.3 Environmental Fate

Abiotic Degradation

Abiotic degradation rates for fluazifop-butyl and fluazifop-p-butyl are similar. Hydrolysis rates for fluazifop-butyl and fluazifop-p-butyl decreased with pH. The half-life ranged from 0.2 to 2.5 days, respectively, at pH 9, 78 days to stable at pH 7, and both were stable at pH 4 and 5 (Table 3-1). Fluazifop-acid and fluazifop-p-acid were stable to hydrolysis in water (Negre *et al.* 1988; MRID 46190601). Fluazifop-butyl and fluazifop-p-butyl were essentially stable to photolysis in water and soil (MRID 93788, 93789, 41598002). Overall, these results indicate that chemical degradation will play a minor role in fluazifop-butyl and fluazifop-acid degradation because microbial degradation rates were faster than the chemical degradation rates.

Biotic Degradation

Fluazifop-butyl and Fluazifop-p-butyl

Aerobic and anaerobic degradation of fluazifop-butyl and fluazifop-p-butyl can be rapid, *e.g.*, within hours to days, especially in moist soils and aerobic aquatic systems (MRID 87493, 92067033, 87492,162455, 46190605; Smith 1987). However, fluazifop-butyl may be more stable to aerobic and anaerobic degradation in some soils under drier conditions, probably because of decreased microbial activity (Negre *et al.* 1988; Smith 1987). The primary degradation pathway is via microbially mediated hydrolysis (Figure 2-1). Overall, these results indicate that in most use scenarios and soils fluazifop-butyl and fluazifop-p-butyl will rapidly (within hours to days) hydrolyze to the corresponding fluazifop-acid; however, when the soil is dry or has little microbial activity, it will degrade more slowly.

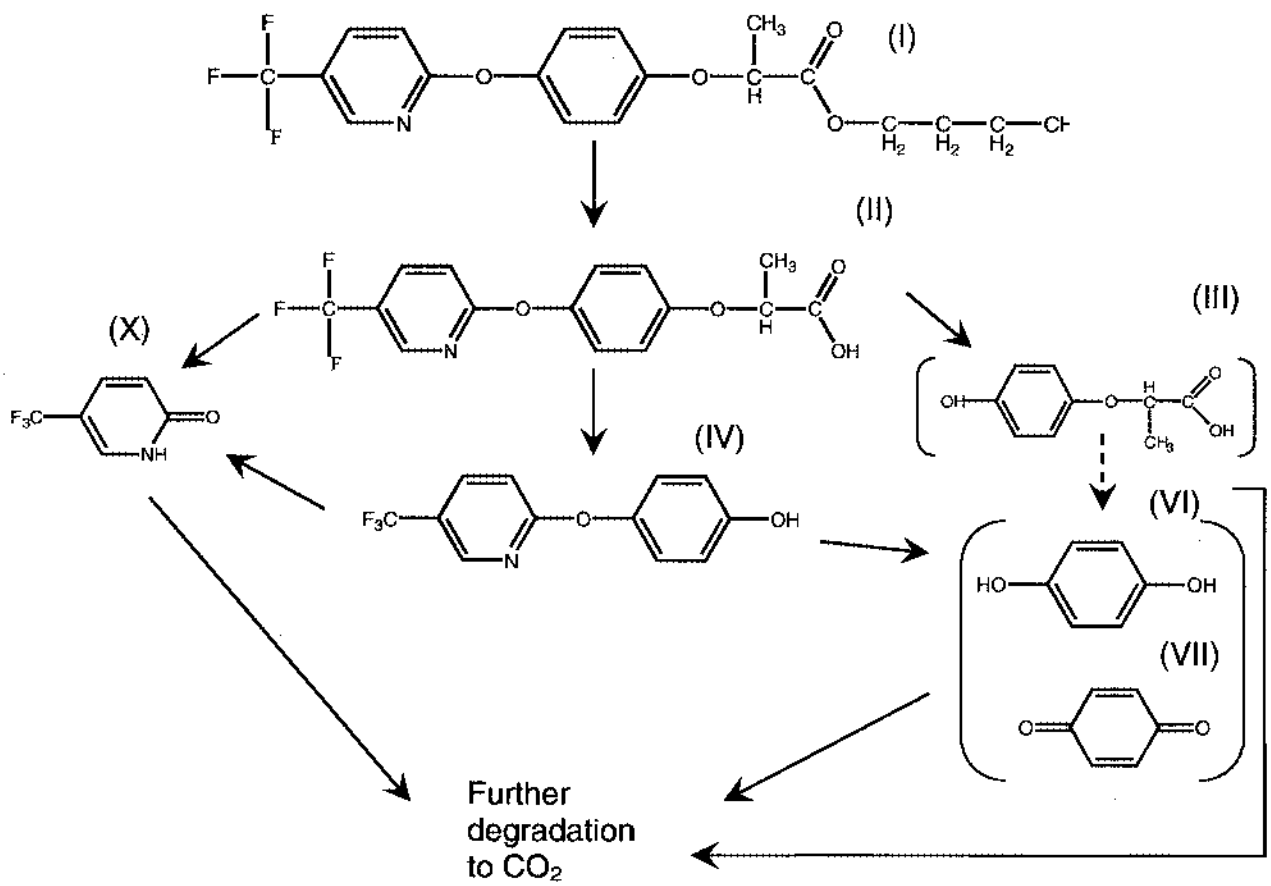


Figure 2-1. Degradation Pathway of Fluazifop-Butyl

The names of compounds are available Table A 1and can be identified by the number in parentheses. Transient degradates include quinol (VI) and benzoquinone (VII)

Fluazifop-acid and Fluazifop-p-acid

The primary mechanism of degradation for the degradates, fluazifop-p-acid and fluazifop-acid, is also aerobic degradation, primarily through microbially-mediated hydrolysis. Anaerobic degradation may also occur but at a slower rate than aerobic metabolism. Half-lives of fluazifop-p-acid and fluazifop-acid in aerobic soils ranged from 6 - >168 days (MRID 46190602, 87493, 92067033; Kah *et al.* 2007).[1] Aerobic water-sediment metabolism was characterized in two English soils for fluazifop-p-acid and half-lives ranged from 13.7- 108 days (MRID 46190605). In a mixed microbial population the rate of degradation of the S enantiomer of fluazifop-acid was faster than the degradation of the R enantiomer (Negre *et al.* 1993). Anaerobic metabolism was characterized in two English flooded soils and half-lives ranged from 69 -1155 days (MRID 87493, 92067032, DER addendum 10/26/2003; DER addendum#2 8/4/2008).[2]

Field Studies

Dissipation of fluazifop-butyl was examined in five terrestrial field dissipation studies including five different locations or soils. In an acceptable study, the measured half-life was 13 days in a plot of sandy loam soil planted with cotton near Porterville, CA (MRID 41598004). After two applications of 0.75 lb a.i./A with a 28 day application interval, fluazifiop-butyl concentrations ranged from 0.01 to 0.29 ppm and fluazifop-butyl was not measurable (*e.g.*, residues were <0.01 ppm) eight weeks after application (MRID 41598004). The other studies were supplemental for various reasons such as unverified application rates, rototilling of soil after application, results did not agree with laboratory data, major degradates were not examined, or analytical method validation was not submitted. In two of the studies, the soil was rototilled after application (MRIDs 41598003, 41900605). These studies must be considered as having a great deal of uncertainty because rototilling confounds the routes of dissipation and the results cannot be used to understand leaching; however, the estimates reported may be considered as a lower bound of potential field dissipation for fluazifop-butyl and fluazifop-acid and provide information on what is expected in fields that are rototilled after application. Dissipation rates in these studies were both 1.5 days for fluazifop-butyl and 18 days for fluazifop-acid in sandy loam and loam soils planted with cotton in California. In other terrestrial dissipation studies, dissipation rates for fluazifop-butyl ranged from <7 to 17 days and fluazifop-acid dissipation rates ranged from 5 to 83 days.(Table 3-1).

The open literature also reported results from a terrestrial field dissipation study conducted in Egypt in a clay loam soil planted with faba beans, a legume (El-Metwally *et al.* 2007). Fusilade Super E.C. (12.5% fluazifop-p-butyl) was applied to foliage. Initial soil concentrations ranged from 35.62 – 57.57 ppm and decreased by 83-99% over 28 days. Half-lives ranged from four days in cultivated plots to six days in uncultivated plots (El-Metwally *et al.* 2007). Rates of degradation were higher in plots subject to hoeing and inoculated with *Rhizobium.*

[1] These half-lives include half-lives calculated using the total residues of the fluazifop-butyl + fluazifop-acid because not enough data was available to estimate degradation of the parent and these were the supplemental values established for use in risk assessment (DER addendum 10/26/2003).

[2] These half-lives include half-lives calculated using the total residues of the fluazifop-butyl + fluazifop because not enough data was available to estimate degradation of the parent and these were the supplemental values established for use in risk assessment (DER addendum 10/26/2003).

Terrestrial field dissipation studies indicate that fluazifop-butyl and fluazifop-p-butyl have the potential to remain in soil for days to weeks. Contrary to the laboratory studies that showed dissipation of fluazifop-butyl within hours to days, when fluazifop-butyl is applied in the field it could take more than 4 weeks for most of the fluazifop-butyl to dissipate and greater than 83 days for fluazifop-acid to dissipate.

Degradates

Three degradates were measured at greater than ten percent of applied equivalents or total radioactivity recovered including, fluazifop-acid, fluazifop-p-acid, and 2-hydroxy-5-trifluoromethylpyridine (degradate X) (Table A 6). Fluazifop-acid, enantiomer unspecified, reached maximums of 70.2 to 90.3% of total radioactivity recovered in aerobic soil and anaerobic flooded soil metabolism studies with maximums occurring between 2 and 315 days. Fluazifop-p-acid reached maximums of 8.5 to 97.8% of applied equivalents or total radioactivity recovered in metabolism studies with maximums occurring between 2 and 30 days. Degradate X reached maximums ranging from 1.1 to 37.4% of total applied equivalents or radioactivity recovered with maximums occurring between 59 to 315 days.

Half-lives of both fluazifop-acid and degradate X, are greater than half-lives for fluazifop-butyl. The dissipation half-lives reported for fluazifop-acid in the field studies classified as supplemental, that have some associated uncertainty, ranged from 5 to 83 days (Table 3-1). These studies may still be considered as a lower bound of potential field dissipation for fluazifop-acid. The dissipation half-life was 42 days in the most reliable field dissipation study and concentrations in soil ranged from 0.01 to 0.28 ppm (MRID 41598004). Dissipation half-lives of 108 and 241days were reported for degradate X in the supplemental studies that have some uncertainty and concentrations in soil ranged from 0.01 to 0.03 ppm (MRID 41900606, 41900605). These values may be considered as a lower bound of potential field dissipation for degradate X. The reviewer indicated that these concentrations were likely low based on results from aerobic soil metabolism studies that measured higher percentages of degradate X than measured in the terrestrial field dissipation study (DER 10/26/1992). Other minor degradates were 2-(4-hydroxyphenoxy)-5-trifluoromethylpyridine (degradate IV) and 2-(4-hydroxyphenoxy) propionic acid (degradate III). Degradate IV may be considered a major degradate as the maximum percent of applied equivalents fell just below ten percent. The percent of applied equivalents ranged from 0.6 to 9.9% and maximums occurred between 7 and 168 days. Degradate III was not analyzed in any of the acceptable studies.

Mobility

Fluazifop-butyl

No acceptable studies on sorption of fluazifop-p-butyl and fluazifop-butyl have been submitted.

Fluazifop-Acid

Measured K_F values for fluazifop-p-acid ranged from 0.27 to 13.4 L/kg and K_{OC} ranged from 25.93 – 310.8, indicating that fluazifop-p-acid is mobile to moderately mobile (classification based on FAO 2000; MRID 46190603; Kah and Brown 2007).

Fluazifop-acid was highly mobile (log K_{OC} <1) in a clay and sandy loam soil and mobile (log K_{OC} 1-2) in sand and sandy loam British soils (MRID 41900604, classification based on FAO 2000). Freundlich K_F values were 0.23 for the sand soil, 0.14 and 0.17 for the two sandy loam soils, and 0.26 for the clay soil respectively and 1/n ranged from 0.76 to 0.86. Respective Freundlich K_{OC}, values ranged from 8.3 to 51 L/kg (MRID 41900604). Adsorption appeared to be related to pH, with increasing sorption at lower pH's (pH of soils ranged from 5.3-6.8) most likely due to the association state of the acid and the pH-dependent anion exchange capacity of the soil. As fluazifop-p-acid and fluazifop-acid will be present in the anionic form at most environmental pH values, they are expected to be highly mobile. Anions (negatively-charged ions) tend to be weakly sorbed to most soils (in effect, repelled by soil matrix surfaces which are generally negatively charged). Generally speaking, other factors being the same, mobility is expected to decrease with pH for acidic/anionic compounds as more of the compound will be present in its neutral form.

In the most reliable supplemental terrestrial field dissipation study, two samples below the 0-6 inch soil depth had detectable levels of fluazifop-acid (MRID 41598004). At the four-week interval, after the second application, 0.02 ppm fluazifop-acid was found in the 6-12 inch soil depth and 0.01 ppm fluazifop-acid was found in the 30-36 inch soil depth. No fluazifop-acid was found in the deepest sampling depth of 36-48 inches. The groundwater ubiquity score (GUS) developed by Gustafson (1989) ranged from 2.1 to 6.6 for fluazifop-acid.[1] GUS scores above 2.8 indicate that the substance has the potential to leach into groundwater (Corbin *et al.* 2006). Overall, these results indicate the fluazifop-acid and fluazifop-p-acid have the potential to leach into groundwater.

Degradate X

All applied ^{14}C labeled degradate X was measured in water in batch equilibrium studies with a sand, two sandy loam soils, and a clay soil (MRID 41900604). Based on its only measured half-lives of 108 to 241 days in terrestrial field dissipation studies and its propensity to stay in water, degradate X has the potential to move into groundwater.

Bioconcentration/Bioaccumulation

Bioconcentration was examined in bluegill sunfish and channel catfish. Bioconcentration factors in bluegill sunfish, based on the concentration of total ^{14}C-residues in fish tissue and water, were 410 in whole fish, 120 in muscle, 4800 in viscera based on fluazifop-butyl (MRIDs 93796, 92067035). The identity of compounds in the residues were only characterized in the viscera and water. In viscera, 43-45% was fluazifop-acid. Degradate X and 2-(4-hydroxyphenoxy)propionic acid made up 21-25% each. In water, 10-70% of ^{14}C was fluazifop-butyl and 15-48% was fluazifop-acid. As only some of the residues in the viscera were fluazifop-acid, actual bioconcentration factors will be lower. ^{14}C-concentrations in tissue fell rapidly after exposure was stopped with greater than 97 percent eliminated during depuration.

[1] The fluazifop GUS score was calculated using K_F values of 0.14 and 38.5 and soil half-lives of 7.5 and 23 days (MRID 46190602, 46190603, 41900604; Smith 1987).

Bioconcentration/bioaccumulation is not expected to be a significant route of exposure because depuration occurs rapidly and bioconcentration factors are low.

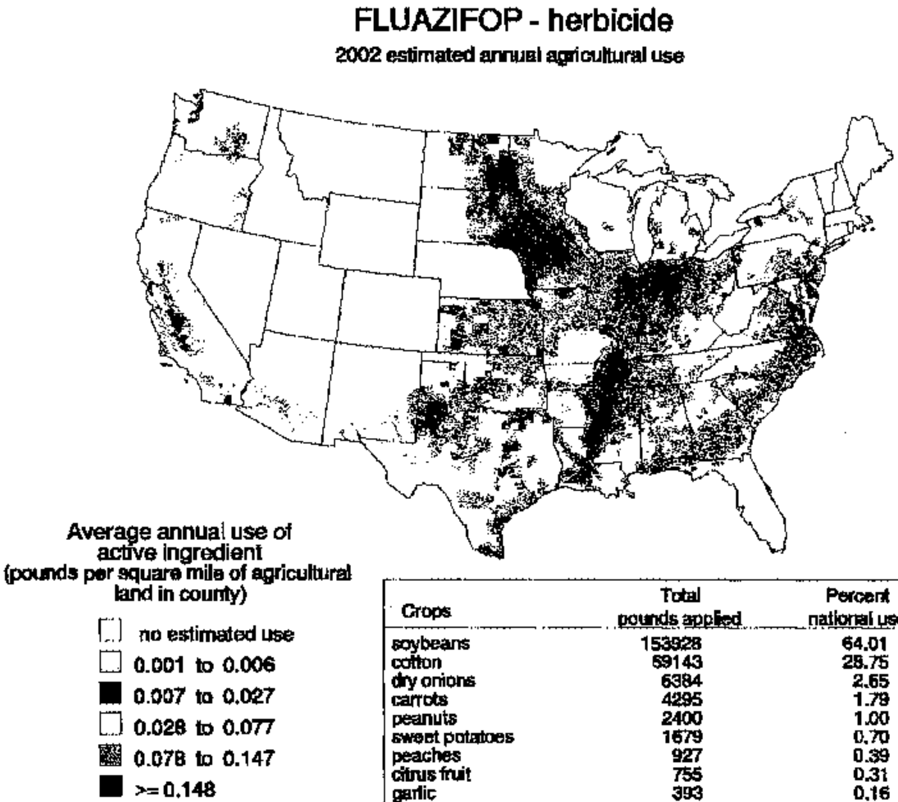
In the study examining bioconcentration in channel catfish, radiolabeled (^{14}C-phenyl and ^{14}C-pyridyl) fluazifop-butyl was applied at 0.5 kg a.i./ha to a loamy sand soil. After 14 days aerobic incubation, the soil was flooded and channel catfish (*Ictalurus punctatus*) were added to the system for an exposure period of up to 65 days. After 28 and 65 days exposure, fish were transferred to flowing, uncontaminated water for 14 and 21 days, respectively. Soil, water, and fish (muscle, viscera, and whole fish) were analyzed for ^{14}C-residues at regular intervals. In the whole fish, the maximum bioconcentration factor (BCF=concentration in fish tissue/concentration in water) measured was 2.1, equal to 0.07 mg fluazifop-acid equivalents/kg wet weight the maximum muscle and viscera bioconcentration factors were 1.1 and 8.0, respectively. The concentration of ^{14}C-residues in the fish fell rapidly during depuration with over 70% of the residues eliminated during depuration.

A more complete discussion of all environmental fate studies available for this risk assessment is included in Section 3.1 and Appendix A.

2.2.4 Overview of Pesticide Usage

Fluazifop-p-butyl is registered as an active ingredient on 19 national labels, 17 state labels, and one emergency use label. Uses include terrestrial agricultural food uses, nonfood uses such as fallow land and noncrop areas, and residential/commercial uses such as for use on turf, ornamentals, and in landscapes. A comprehensive summary of the registered food/feed use patterns was recently completed in 2004 and can be found in *Fluazifop-P-butyl. REVISED TRED – Report on FQPA Tolerance Reassessment Progress and Interim Risk Management Decisions. Residue Chemistry Considerations. Case No. 2285* (US EPA 2005). In 2003, fluazifop-P-butyl was registered for "food/feed use on apricot, asparagus, carrot, cherry, coffee, cotton, endive (escarole), garlic, macadamia nut, nectarine, onion, peach, pecan, pepper, plum, prune, rhubarb, soybean, sweet potato, and yam" (US EPA 2005). Fusilate®DX also allows for use on Tabasco peppers in Louisiana, fallow land, noncrop areas, and on nonbearing crops. The proposed new uses are within the existing use footprint of the previously registered uses, *e.g.*, the new uses will not result in an expanded use area or increased application rates.

While no usage information is available for the proposed new uses, data are available which display the estimated annual use of fluazifop-p-butyl use nationally between 1999 and 2004 (Figure 2-2). Maps on the acres planted with soybeans (Figure 2-3) and peanuts (Figure 2-4) in the United States, excluding Alaska and Hawaii in 2007 show areas where the proposed uses may occur. A map showing harvested acres of dry edible beans in the United States in 2002 (Figure 2-5) and a chart showing the percentage of dry beans produced in different states in 1998 (Figure 2-6) is also provided and also show potential areas where the proposed uses may occur.



Crops	Total pounds applied	Percent national use
soybeans	153928	64.01
cotton	69143	28.75
dry onions	6384	2.65
carrots	4295	1.79
peanuts	2400	1.00
sweet potatoes	1679	0.70
peaches	927	0.39
citrus fruit	755	0.31
garlic	393	0.16
asparagus	320	0.13

Figure 2-2. Typical Usage of Fluazifop-butyl Between 1999 and 2004

(From the Pesticide National Synthesis Project available at:
http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=02&map=m9007)

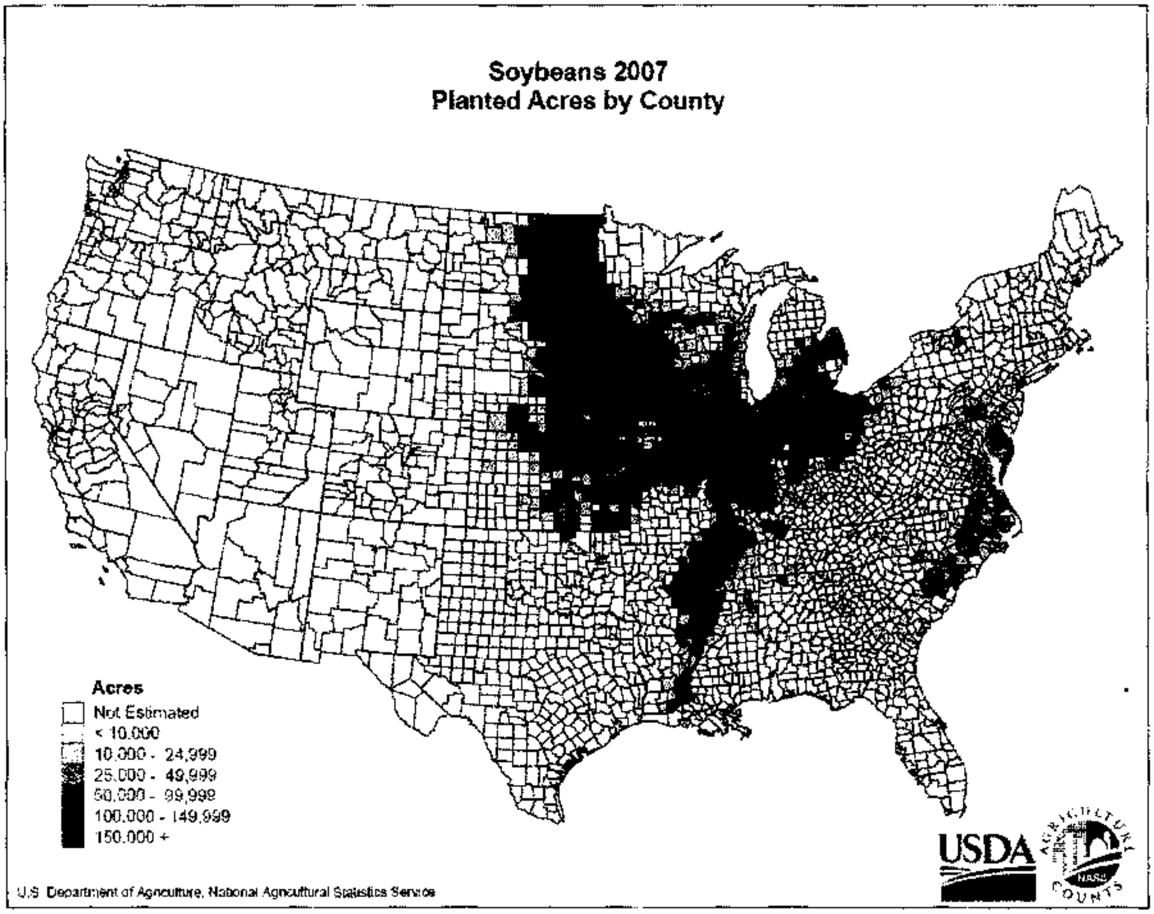


Figure 2-3. Total Acres Planted with Soybeans in 2007 in the United States, Excluding Alaska and Hawaii

(From National Agricultural Statistics Service available at:
http://www.nass.usda.gov/Charts_and_Maps/Crops_County/pdf/SB-PL07-RGBChor.pdf)

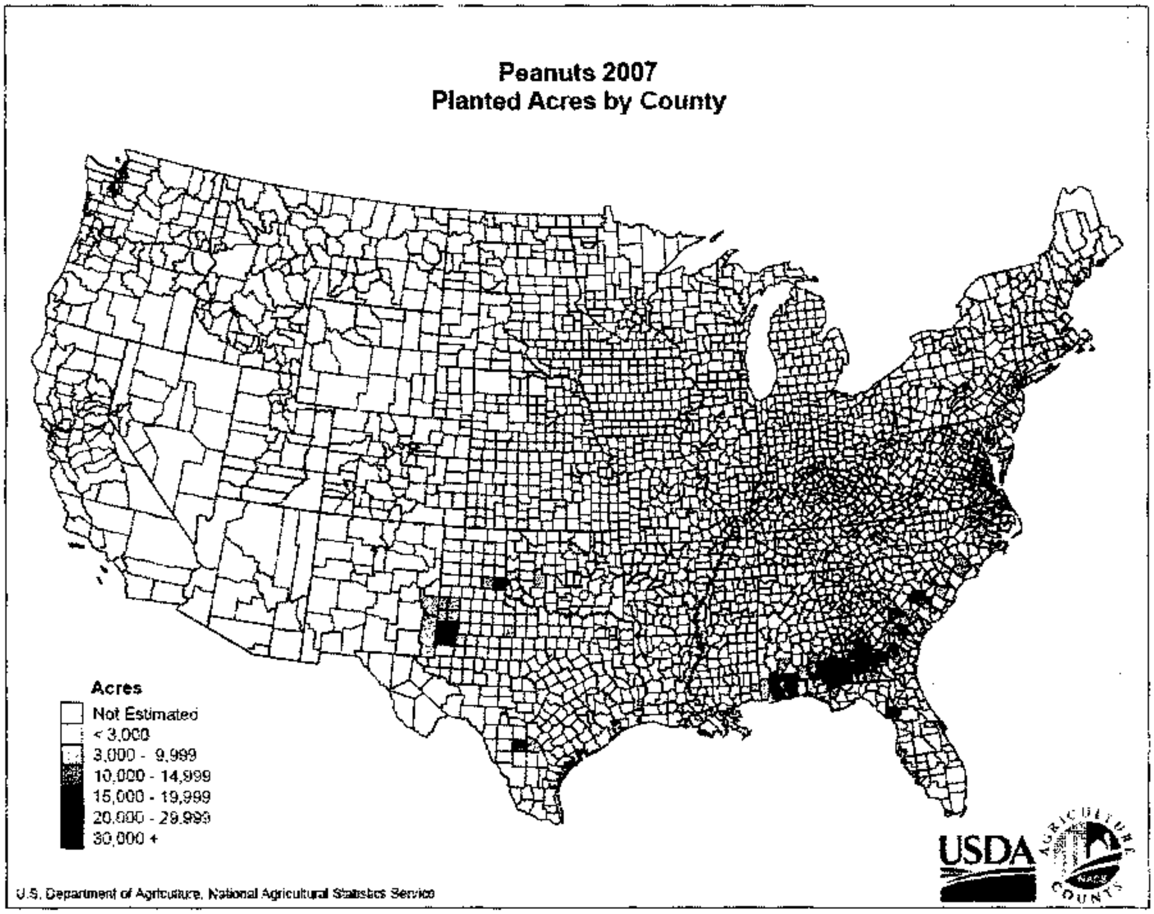


Figure 2-4. Total Acres Planted with Peanuts in 2007 in the United States, Excluding Alaska and Hawaii

(From National Agricultural Statistics Service available at: http://www.nass.usda.gov/Charts_and_Maps/Crops_County/pdf/PE-PL07-RGBChor.pdf)

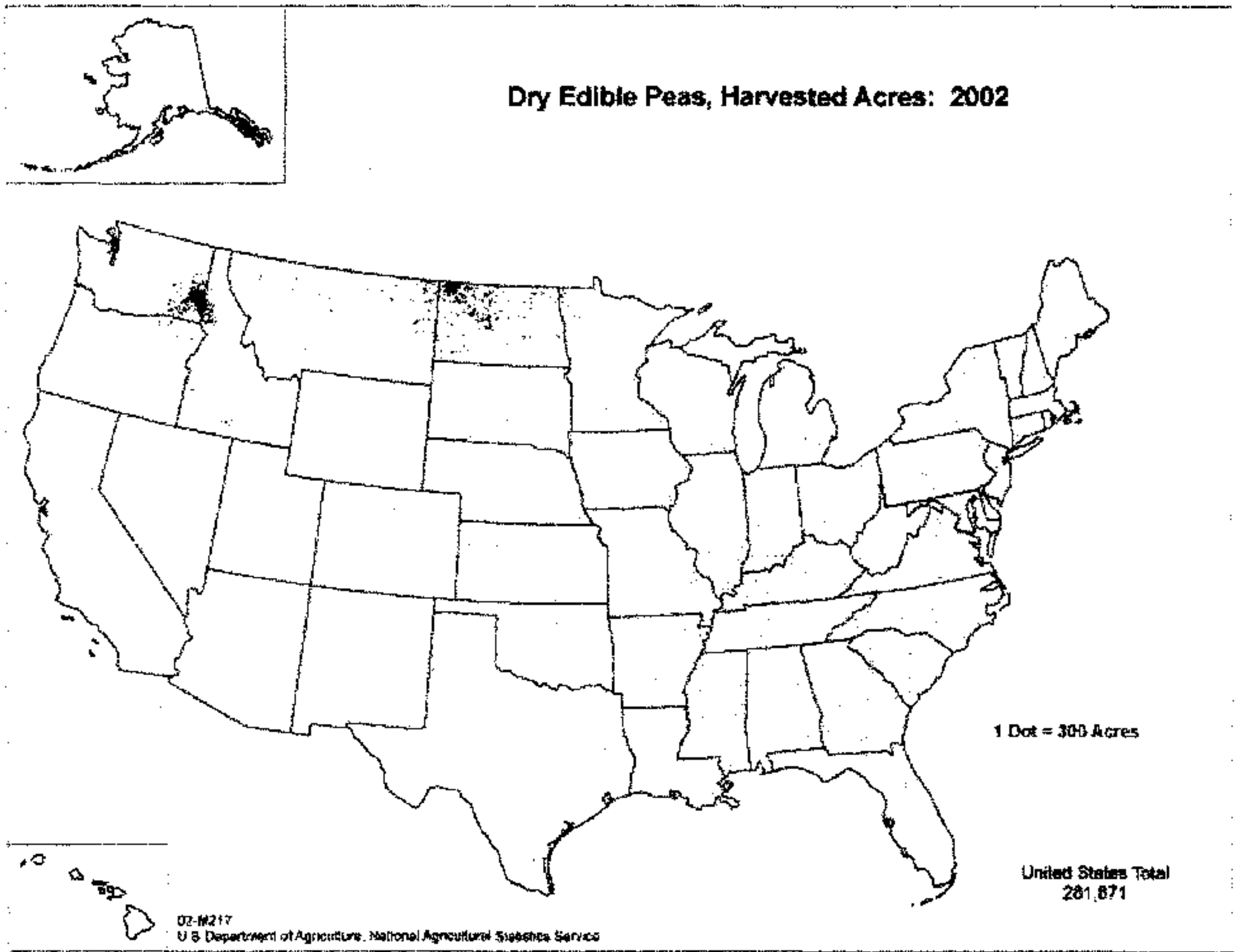


Figure 2-5. Total Acres Dry Edible Peas Harvested in the United States in 2002

(From National Agricultural Statistics Service available at:
http://www.nass.usda.gov/Charts_and_Maps/Crops_County/pdf/SB-PL07-RGBChor.pdf)

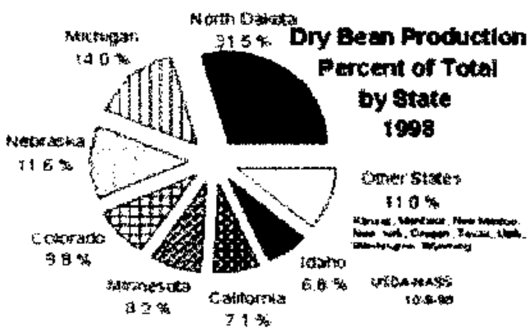


Figure 2-6. Percent of Total Dry Bean Production by State in 1998

(From National Agricultural Statistics Service available at:
http://www.nass.usda.gov/Charts_and_Maps/Dry_Beans,_Dry_Peas,_and_Lentils/dbstate.asp)

The proposed label (FUSILADE®DX, EPA Reg. No. 100-1070) amendment is for a flowable of fluazifop-p-butyl (24.5% a.i) for use as a selective post-emergent herbicide to control perennial and annual grass weeds. The product is to be applied by ground, chemigation, and aerial applications. With aerial applications, the distance of the outer-most nozzles on the boom must exceed ¾ the length and applications should not be made at a height greater than 10 feet above the top of the largest plants, unless a greater height is required for aircraft safety. For chemigation, irrigation systems such as center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, or hand move may be used and a functional check valve. Table 2-3 summarizes the registered uses and proposed uses on the Fusilate®DX (EPA Reg. No. 100-1070) label.

Table 2-3. Proposed and Previously Registered Uses on the Fusilade®DX (EPA Reg No. 100-1070) Label

Crop/ Use	Recommended Single Application Rates	Maximum Single Application Rate[1]		Maximum Seasonal Application Rate[2]		Application Interval
	oz./A	oz./A	lbs. a.i./A	oz./A	lbs. a.i./A	days
Uses Previously Registered on Fusilade® DX Label						
Apricots Cherries Nectarines Peaches Plums Prunes	4-24 region A[3] 12-24 region B[4]	NS	0.38	72	1.13	NS
Asparagus - all states except CA and AZ	8-12 region A 12 region B	24	0.19	48	0.75	14
Asparagus - CA only	8-12 region A 12 region B	12	0.19	24	0.38	21
Carrots	8-12 region A 12 region B	NS	0.19	48	0.75	NS
Coffee (Hawaii only)	16-24	NS	0.38	48	0.75	NS
Cotton	8-12 region A 12 region B	NS	0.19	48	0.75	NS
Macadamia Nuts	8-12 region A 12 region B	NS	0.19	48	0.75	NS
Pecans	8-12 region A 12 region B	NS	0.19	72	1.13	NS
Rhubarb (MD and NJ only)	8-12 region A 12 region B	NS	0.19	36 / season 76 / 2 years	0.56 / season 1.19 / 2 years	NS
Soybeans	4-12 oz. region A 12-24 oz region B	NS	0.38	30	0.47	NS
Sweet Potatoes and Yams	8-12 region A 12 region B	NS	0.19	48	0.75	NS

Crop/ Use	Recommended Single Application Rates	Maximum Single Application Rate[1]		Maximum Seasonal Application Rate[2]		Application Interval
	oz./A	oz./A	lbs. a.i./A	oz./A	lbs. a.i./A	days
Tabasco Peppers (LA only)	8-12 region A 12 region B	NS	0.19	48	0.75	NS
Nonbearing Crops	16-24 region A and B	NS	0.38	72	1.13	NS
Agricultural Fallow Land and Noncrop Areas	16-24 region A and B	NS	0.38	72	1.13	NS
Proposed Uses on Fusilade® DX Label						
Dry Beans	8-12 region A 12 region B	24	0.38	48	0.75	14
Peanuts	8-12 region A 12 region B	24	0.38	48	0.75	14
Soybeans	4-12 oz. region A 12-24 oz region B	NS	0.38	30	0.47	NS
prebloom (up to V5 growth stage)	NS	NS	0.38	24	0.38	NS
Bloom to post bloom (R1 growth stage and later)	NS	NS	0.09	6	0.09	NS

Abbreviations: oz./A refers to the total fluid ounces of product (24.5% a.i.) per acre as specified on the label;lbs.a.i./A =pounds active ingredient per acre as converted from oz/A; A=Acre; a.i.=active ingredient; NS=not specified

1 Calculated as Maximum single application rate (ounces per A) or Recommended Single Application Rates (ounces per A) x 0.375 lbs a.i./24 oz.(from conversion table on label).

2 Calculated as Maximum seasonal application rate (ounces per A) x 0.375 lbs a.i./24 oz.(from conversion table on label).

3 Region A includes Alabama, Alaska, Arkansas, Northern California, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Northern Nevada, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, east of Interstate 35 in Oklahoma, Oregon, Pennsylvania, Puerto Rico, Rhode Island, South Carolina, South Dakota, Tennessee, east of Interstate 35 in Texas, Northern Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming

4 Region B includes Arizona, Southern California, Colorado, Hawaii, West of Interstate35 in Oklahoma, Southern Nevada, New Mexico, Southern Utah, and west of Interstate 35 in Texas

2.3 Receptors

In order for a chemical to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. An exposure pathway is the means by which a contaminant moves in the environment from a source to an ecological receptor. For an ecological exposure pathway to be complete, it must have a source, a release mechanism, an environmental transport medium, a point of exposure for ecological receptors, and a feasible route of exposure. In addition, the potential mechanisms of transformation (i.e., which degradates may form in the environment, in which media, and how much) must be known, especially for a chemical whose metabolites/degradates are of greater toxicological concern. The assessment of ecological exposure pathways, therefore, includes an examination of the source and potential migration pathways for constituents, and the determination of potential exposure routes (*e.g.*, ingestion, inhalation, and dermal absorption).

Ecological receptors that may potentially be exposed to fluazifop-butyl and its degradates on-field or off-field from spray drift or run-off include terrestrial wildlife (*i.e.*, invertebrates, mammals, birds, and reptiles), and terrestrial and semi-aquatic plants. In addition to terrestrial ecological receptors, aquatic receptors (*e.g.*, freshwater and estuarine/marine fish and invertebrates, amphibians, aquatic plants) may also be exposed to potential migration of pesticides from the site of application to various watersheds and other aquatic environments via runoff and drift.

The receptor is the biological entity that is exposed to the stressor (EPA 1998). Consistent with the process described in the Overview Document (EPA 2004a), this risk assessment uses a surrogate species approach in its evaluation of fluazifop-p-butyl. Toxicological data generated from surrogate test species, which are intended to be representative of broad taxonomic groups, are used to extrapolate to potential effects on a variety of species (receptors) included under these taxonomic groupings.

Acute and chronic toxicity data from studies submitted by pesticide registrants are used to evaluate the potential direct effects of fluazifop-butyl and fluazifop-acid to the aquatic and terrestrial receptors identified in this section. This includes toxicity data on the technical grade active ingredient, degradates, and when available, formulated products (*e.g.* "Six-Pack" studies).

Table 2-4 provides a summary of the taxonomic groups and the surrogate species tested to help understand potential acute ecological effects of pesticides to non-target organisms in each taxonomic group. In addition, the table provides a preliminary overview of the potential acute toxicity of fluazifop-butyl and fluazifop-acid by providing the acute toxicity classifications.

A complete discussion of all toxicity data available for this risk assessment and the resulting measurement endpoints selected for each taxonomic group are included in Table 2-5 in the Measures of Risk section 2.7.5.

Table 2-4 Test Species Evaluated for Assessing Potential Ecological Effects of Associated Acute Toxicity Classification

Taxonomic Group	Example(s) of Surrogate Species	Acute Toxicity Classification
Birds[1]	Mallard (*Anas platyrhynchos*)	Practically non-toxic
Mammals	Laboratory rat (*Rattus norvegicus*)	Slightly toxic
Terrestrial Invertebrates	Honey Bee (*Apis mellifera*)	Practically non-toxic
Freshwater fish[2]	Fathead minnow (*Pimephales promelas*)	Very highly toxic
Freshwater invertebrates	Water flea (*Daphnia magna*)	Very highly toxic

Taxonomic Group	Example(s) of Surrogate Species	Acute Toxicity Classification
Estuarine/marine fish	Sheepshead Minnow (*Cyprinodon variegatus*)	Very highly toxic
Estuarine/marine invertebrates	Pacific Oyster (*Crassostrea gigas*)	Very highly toxic
Aquatic plants and algae	None Reported	Not applicable

1 Birds also represent surrogates for terrestrial-phase amphibians and reptiles in this assessment.
2 Freshwater fish may also be surrogates for aquatic-phase amphibians in this assessment.

2.4 Ecosystems Potentially at Risk

The ecosystems at risk are often extensive in scope, and as a result it may not be possible to identify specific ecosystems during the development of a baseline risk assessment. However, in general terms, terrestrial ecosystems potentially at risk could include the treated field and areas immediately adjacent to the treated field that may receive drift or runoff. Areas adjacent to the treated field could include cultivated fields, fencerows and hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats and other uncultivated areas.

Aquatic ecosystems potentially at risk include water bodies adjacent to, or down stream from, the treated field and might include impounded bodies such as ponds, lakes and reservoirs, or flowing waterways such as streams or rivers. For uses in coastal areas, aquatic habitat also includes marine ecosystems, including estuaries. For Tier 1 assessment purposes, risk will be assessed to aquatic animals and plants assumed to occur in small, static ponds receiving runoff and drift from adjacent treated areas.

2.5 Assessment Endpoints

Assessment endpoints represent the actual environmental value that is to be protected, defined by an ecological entity (species, community, or other entity) and its attribute or characteristics (EPA 1998). For fluazifop-p-butyl, the ecological entities may include the following: birds, mammals, reptiles, amphibians, freshwater fish and invertebrates, estuarine/marine fish and invertebrates, terrestrial plants, beneficial insects, and aquatic plants and algae. The attributes for each of these entities may include growth, reproduction, and survival.

Selection of the assessment endpoints is based on valued entities (*i.e.*, ecological receptors), the ecosystems potentially at risk, the migration pathways of pesticides, and the routes by which ecological receptors are exposed to pesticide-related contamination. The selection of clearly defined assessment endpoints is important because they provide direction and boundaries in the risk assessment for addressing risk management issues of concern.

For both aquatic and terrestrial animal species, direct acute and direct chronic exposures are considered. In order to address risk to threatened and endangered species, all assessment endpoints are measured at the individual level. Although all endpoints are measured at the individual level, they provide insight about risks at higher levels of biological organization (*e.g.* populations and communities). For example, pesticide effects on individual survivorship have important implications for both population rates of increase and habitat carrying capacity.

For aquatic plants, the assessment endpoint is the maintenance and growth of standing crop or biomass. Measurement endpoints for this assessment endpoint focus on algal and vascular plant growth rates and biomass measurements. Although it is recognized that these endpoints may not address all plant life cycle components, it is assumed that these impacts have the potential to impact individual competitive ability and reproductive success.

The ecological relevance of selecting these assessment endpoints is as follows:

- Complete exposure pathways exist for these receptors.
- The receptors may be potentially sensitive to pesticides in affected media.
- The receptors could potentially inhabit areas where pesticides are applied, or areas where runoff and/or spray drift may impact the sites because suitable habitat is available.

A summary of the assessment and measurement endpoints selected to characterize potential ecological risks associated with exposure to fluazifop-p-butyl and fluazifop-acid is provided in Table 2-5.

2.6 Conceptual Model

For a pesticide to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. An exposure pathway is the means by which a pesticide moves in the environment from a source to an ecological receptor. For an ecological pathway to be complete, it must have a source, a release mechanism, an environmental transport medium, a point of exposure for ecological receptors, and a feasible route of exposure. The assessment of ecological exposure pathways, therefore, includes examination of the source and potential fate and transport pathways for the pesticide, and the determination of potential exposure routes, (*e.g.*, ingestion, inhalation, and dermal contact).

A conceptual model provides a written description and visual representation of the predicted relationships between fluazifop-butyl and fluazifop-acid, potential routes of exposure, and the predicted effects for the assessment endpoint. A conceptual model consists of two major components: risk hypothesis and a conceptual diagram (EPA 1998).

2.6.1 Risk Hypothesis

For fluazifop-butyl and fluazifop-acid, the following ecological risk hypothesis is being employed for this baseline risk assessment:

> Fluazifop-butyl, when used in accordance with the label, results in potential adverse effects upon the survival, growth, and reproduction of non-target terrestrial and aquatic organisms. Given the physical characteristics of fluazifop-butyl and fluazifop-acid and degradation and dissipation half-lives, there is a likelihood of exposure to terrestrial and/or aquatic organisms.

2.6.2 Conceptual Diagram

Based on the potential behavior of fluazifop-butyl and fluazifop-acid in the environment and the proposed method of application (*e.g.*, ground spray application, chemigation, or aerial application), a conceptual model was developed that represents the sources and transport mechanisms of fluazifop-butyl and fluazifop-acid and their relationship to the receptors and potential attribute changes (*e.g.*, survival, reduced biomass) in the receptors (*e.g.*, organisms or ecosystems) due to exposure to cumyluron.

Figure 2-7 depicts the potential exposure pathways associated with the proposed use of fluazifop-butyl and fluazifop-acid. The conceptual model generically depicts the potential source of fluazifop-butyl, release mechanisms, abiotic and biotic receiving media, biological receptors, and attribute changes of potential concern and the measurement endpoints used to evaluate them.

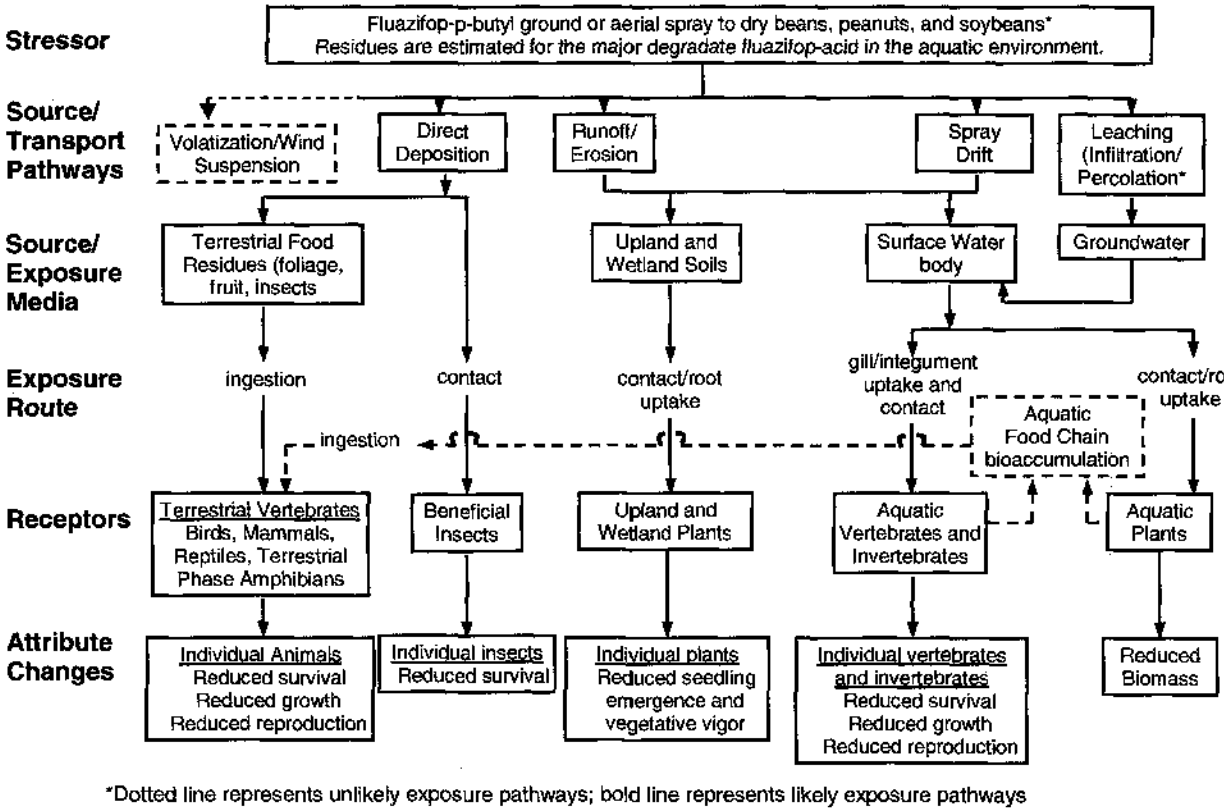


Figure 2-7. Conceptual Diagram for Assessment of Risks from Fluazifop-p-butyl use on Dry Beans, Peanuts, and Soybeans

Based on the use pattern for fluazifop-p-butyl, the main exposure pathways for terrestrial organisms are direct exposure to fluazifop-butyl via consumption of food items. In the figure above, the dashed line represents the pathways of exposure that are unlikely to occur because of physical or chemical properties. Log K_{ow}s of fluazifop-butyl and fluazifop-acid are 4.5 and 3.18, respectively, BCF in bluegill sunfish were 410 (whole fish), 120 (fillet), and 4800 in the nonedible tissue; indicating that bioconcentration in aquatic organisms is low. Because of this characteristic, use of fluazifop-butyl and fluazifop-acid are not expected to result in significant exposure via the food chain. While White *et al* (2006) detected fluazifop-butyl in trace amounts in air at a potato farm in Canada, volatization is not expected to be a concern in most instances due to the low vapor pressures of fluazifop-butyl and fluazifop-acid.

2.7 Analysis Plan

This analysis plan identifies the approach, methods, specific models, information, and data that will be used to estimate and evaluate risks from proposed uses of fluazifop-p-butyl. During this step measures of exposure and measures of effect are used to evaluate the risk hypotheses and are listed in Table 2-4 and Table 2-5 for a specific assessment endpoint. A risk quotient (RQ) is obtained by dividing the measures of exposure for a particular assessment endpoint by the measures of effect for that endpoint. The risk quotient is then compared to a level of concern (LOC) established by the Agency for the risk determination.

2.7.1 Conclusions from Previous Risk Assessments

Several assessments were done on fluazifop-butyl in the late 1980's and early 1990's. However, this assessment is the first such analysis to be performed on fluazifop-p-butyl.

2.7.2 Preliminary Identification of Data Gaps

No acceptable data were submitted for chronic toxicity to estuarine/marine fish or invertebrates. Therefore an ACR value was obtained from the freshwater animal studies and applied to the acute toxicity data for estuarine/marine species to derive chronic toxicity values. No toxicity data have been submitted regarding the toxicity of fluazifop-p-butyl to plants. Risks to monocot plants are presumed due to the fact that fluazifop-p-butyl is a selective herbicide intended to control monocot plants. Risks to dicot aquatic plants are presumed to be minimal due to the fact that it is used routinely on dicot plant crops and no incidents of damage to these species have been reported. Risks to algae and lichens are presumed in the absence of data.

2.7.3 Measures of Effects and Exposure

This section describes the tools and methods used to conduct the analysis of the pesticide described in the analysis plan. Each assessment endpoint requires one or more measures of ecological effects, which are measurable changes in the attribute of an assessment endpoint in response to a stressor. It also requires measures of exposure, which are the measures of stressor existence and movement in the environment and their contact or co-occurrence with the assessment endpoint.

2.7.3.1 Estimating Exposure in Terrestrial Systems

For birds and mammals, the screening assessment of the terrestrial dietary exposure route for uptake of pesticide active ingredient assumes that organisms are exposed to a single pesticide residue level for both acute and chronic exposure estimates. Estimated exposure concentrations (EECs) in wildlife food items focus on quantifying possible dietary ingestion of residues on vegetative matter and insects on the treated field as the highest residue level that will occur from fluazifop-p-butyl use proposed by the label. EFED uses different EECs for a variety of food substrates. Those food substrates are: short grass, tall grass, broadleaf plans/small insects, and fruits/pods/seeds/large insects. The EECs are based on a nomogram that relates food item residues to pesticide application rate (Hoerger and Kenaga 1972) as modified by Fletcher *et al.* (1994). The maximum Kenaga value represents residue levels present immediately following chemical application (day zero). The mean Kenaga value represents mean residue levels present (considering day 0 and day 100 residue levels). The first tier nomogram uses the maximum predicted residues immediately following application. The residue concentrations are converted to an oral dose based on fractions of body weight consumed daily as estimated from mammalian allometric relationships in EPA's Wildlife Exposure Factors Handbook (1996). The EECs for birds are adjusted based on food in-take and body weight differences, so that they are comparable for a given weight class of animal. In all screening-level assessments, the organisms are assumed to consume 100% of their diet as one food type. The Terrestrial Residue Exposure Model version 1.3.1 (T-REX) was employed to estimate (1) EECs for different food items for birds and mammals, (2) dose/diet based risk to birds as well as dose based risk to mammals, and (3) EECs for small and large insects to estimate risk to terrestrial invertebrates. The TREX input parameters are given in the terrestrial exposure section.

2.7.3.2 Estimating Exposure in Aquatic Systems

Tier II estimated environmental concentrations (EECs) for surface water are estimated using PRZM (Pesticide Root Zone Model; version 3.12.2, May 12, 2005) and EXAMS (EXposure Analysis Modeling System; Version 2.98.04.06) aquatic models that are linked with PE5 (November 15, 2006). The program PE5 is a graphical interface (shell) used by the Environmental Fate and Effects Division (EFED) of the Office of Pesticides Programs (OPP) and the Pesticide Management Regulatory Agency (PMRA) of Health Canada to facilitate putting chemical- and use-specific input values into the proper positions in the PRZM input (inp) and the EXAMS chemical files.

Description and documentation for these models can be found at http://www.epa.gov/oppefed1/models/water/.

Selection of input parameters followed the "*Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides*", Version II, February 28, 2002 (available at: http://www.epa.gov/oppefed1/models/water/input_guidance2_28_02.htm).

2.7.4 Measures of Effects

Each assessment endpoint requires one or more "measures of ecological effect," which are defined as changes in the attributes of an assessment endpoint itself or changes in a surrogate entity or attribute in response to exposure to a pesticide. Ecological measurement endpoints for the screening level risk assessment are based on a suite of registrant-submitted toxicity studies performed on a limited number of organisms in the following broad groupings:

- Birds (*e.g.*, mallard duck and bobwhite quail; and one passerine species) which are also used as surrogate species for terrestrial- phase amphibians and reptiles;
- Mammals (*e.g.*, laboratory rat);

- Freshwater fish (*e.g.*, bluegill sunfish and rainbow trout) which are also used as a surrogate for aquatic-phase amphibians;
- Freshwater invertebrates (*e.g.*, *Daphnia magna*);
- Estuarine/marine fish (*e.g.*, Sheepshead minnow *Cyprinodon variegatus*);
- Estuarine/marine invertebrates (*e.g.*, *Crassostrea virginica* and *Mysidopsis bahia*);
- Terrestrial plants (*e.g.*, corn, onion, ryegrass, wheat, buckwheat, cucumber, soybean, sunflower, tomato, and turnip); and
- Aquatic plants and algae (*e.g.*, *Lemna gibba* and *Selenastrum capricornutum*).

Within each of these very broad taxonomic groups, an acute and chronic endpoint is selected from the available test data, as the data sets allow. A summary of the assessment and measurement endpoints selected to characterize potential ecological risks associated with exposure to fluazifop-p-butyl is provided in Section 3.3.

2.7.5 Measures of Risk

Integration of effects and potential exposure provide an estimate of potential adverse effects (risk) to non-target endangered/threatened and non-endangered animals and plants that could potentially impact the registration decision of new uses of fluazifop-p-butyl under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Food Quality Protection Act (FQPA), and the Endangered Species Act (ESA). A risk quotient approach (ratio of exposure concentration to effects concentration, described in Section 4.0 was used to determine whether risk of adverse effects to non-target terrestrial and aquatic animals are above Levels of Concern (LOCs) established by the Agency. Table 2-5 provides a summary of the toxicity and exposure endpoints that are used to calculate risk quotients.

Table 2-5. Measures of Ecological Effects and Exposure for Use of Fluazifop-p-butyl

Assessment Endpoint		Selected Surrogate Species and Measure of Ecological Effect[1]	Measures of Exposure
Birds[2]	Acute Survival	Mallard (*Anas platyrhynchos*) acute oral LD_{50} (most sensitive avian acute oral LD_{50})	Maximum residues on dietary food items (dietary Estimated Environmental Concentrations (EEC))
	Survival, reproduction and growth	Bobwhite quail (*Colinus virginianus*) Reproduction NOAEL	
Mammals	Acute Survival	Lab Rat (*Rattus norvegicus*) acute oral LD_{50} (most sensitive acute oral study)	
	Survival, reproduction and growth	Lab Rat (*Rattus norvegicus*) 2-generation reproductive NOAEC (most sensitive reproduction NOAEC)	
Terrestrial Invertebrates	Acute Survival	Honey Bee (*Apis mellifera*) acute contact study (single study available)	μg fluazifop-p-butyl /Animal
Terrestrial Plants	Survival and growth	No Data Submitted	Soil loading (EEC) from runoff and spray drift
Freshwater fish[3]	Acute Survival	Bluegill sunfish (*Lepomis macrochirus*) 96-h LC_{50} (most sensitive 96-h fish acute LC_{50})	Surface water daily peak EEC[4]
	Reproduction and Growth	Fathead Minnow (*Pimephales promelas*) 30 day exposure	Surface water 60-day average peak EEC[4]
Freshwater invertebrates	Acute Survival	Water Flea (*Daphnia magna*) 46-h EC_{50} (most sensitive freshwater invertebrate 48-h EC_{50} or 96-h LC_{50})	Surface water daily peak EEC[4]
	Survival, reproduction[5] and growth	Water Flea (*D. magna*) Life cycle NOAEC (single freshwater invertebrate life cycle study available)	Surface water 21-day average peak EEC[4]
Estuarine/ marine fish	Acute Survival	Sheepshead Minnow (*Cyprinodon variegatus*) 96-h LC_{50} (single estuarine/marine fish acute 96-h LC_{50} available)	Surface water daily peak EEC[4]
	Reproduction and Growth	No Data Submitted	Surface water 60-day average peak EEC[4]
Estuarine/ marine invertebrates	Acute Survival	Pacific Oyster (*Crassostrea gigas*) 48h EC_{50} (most sensitive estuarine/marine acute LC_{50} or IC_{50} available)	Surface water daily peak EEC[4]
	Survival, reproduction and growth	No Data Submitted	Surface water 21-day average peak EEC[4]
Aquatic plants	Biomass and Growth Rate	No Data Submitted	Surface water daily peak EEC[4]
	Biomass and Growth Rate	No Data Submitted	

LD_{50} = Lethal dose to 50% of the exposed test population; NOAEC = No observed adverse effect concentration; NOAEL = No observed adverse effect level; LC_{50} = Lethal concentration to 50% of the exposed test population; EC_{50} = Effect concentration to 50% of the test population; IC_{50}= inhibition concentration resulting in a 50% inhibition in the test population response (e.g., growth rate, biomass)

1 Values listed in this table represent the most sensitive study result within the taxonomic group and for the measurement endpoint identified to evaluate attribute changes.

2 Birds represent surrogates for amphibians (terrestrial-phase) and reptiles.

3 Freshwater fish are used here as surrogates for amphibians (aquatic-phase).

4 One in 10-year return frequency. Aquatic EECs are based on the modeling described in Sections 3.2.1.1.

5 Sensitive early-life stage embryo development, hatching success, and survival and growth of the young are used as a measure of reproduction success.

3.0 Analysis

3.1 Exposure Characterization

Exposure is the contact or co-occurrence between a stressor (*e.g.*, fluazifop-butyl or fluazifop-acid) and a receptor (*e.g.*, organisms/ecosystems exposed). The objective of exposure assessment is to describe exposure in terms of intensity, space, and time in units that can be combined with the effects assessment (USEPA 1998) presented in Section 3.3.

3.2 Environmental Fate and Transport Characterization

Fluazifop-butyl will enter the environment via spray directly onto foliage and soil. It may move off-site via spray drift or wind movement of soil. During rainfall or other precipitation events it may move off the field via water runoff, soil erosion, or leaching. Because of its short half-lives in moist soil (hours to days), fluazifop-butyl is not expected to reach surface water through run-off and soil erosion. However, this cannot be ruled out because it has been detected in surface water and groundwater. In water and sediment, it will rapidly degrade to fluazifop-acid which is highly mobile and has the potential to reach ground water and surface water through leaching, runoff, and spray drift.

The physicochemical properties and environmental fate studies are summarized in Section 2.2.2 and 2.2.3. Table 3-1 summarizes the results of metabolism and terrestrial field dissipation studies for fluazifop-butyl and fluazifop-acid. Appendix A provides a complete summary of each environmental fate study.

Table 3-1. Summary of Degradation and Dissipation Studies for Fluazifop-p-butyl and Related Compounds[1]

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Media	Half-Life (days)			
				Fluazifop-p-butyl	Fluazifop-butyl	Fluazifop-p-acid	Fluazifop-acid
41598001 (1989)	Hydrolysis	Acceptable (10/26/1992)	Buffered water	pH 5; Stable pH 7; 78 pH 9; 0.4	--	--	--
87529 (1980)	Hydrolysis	Not classified	Buffered or distilled water	--	pH 4; >120 pH 6; 35 pH 7; 17 pH 9; 0.2	--	--
Negre *et al.* (1988)	Hydrolysis	Not used in modeling	Filtered and deionized mili-Q water	--	pH 4; Stable pH 7; Stable pH 9; 2.5	--	Fluazifop-acid showed minimal hydrolysis at pH 9
46190601 (1995)	Hydrolysis	Acceptable (DER 4/29/2005)	Sterile buffered solution	--	--	pH 5; Stable pH 7; Stable pH 9; Stable	--
93788 (1981)	Photolysis in Water	Not classified	Sterile water	--	Stable	--	--
41598002 (1989)	Photolysis in Soil	Acceptable (10/26/1992)	Loam soil	195	--	--	--
93789 (1981)	Photolysis in Soil	Not classified	Loam soil	--	Stable	--	--
Negre *et al.* (1988)	Sterile soil	Not used in modeling	Sandy loam	--	3 (pseudo first order)	--	--
162455 (1984)	Aerobic Soil	Not Classified	Sandy loam (British classification)	2 hours, half-life for the S form was also 2 hours	--	--	--
87493 (1981) 92067032	Aerobic soil	Unacceptable (DER 10/26/1992)	Sandy loam, 18 Acres	--	<2[3], all soils	--	Acid: 43-60 Parent + acid: 39-48[12] Parent+acid+unextracted: 178 -182

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Media	Half-Life (days)			
				Fluazifop-p-butyl	Fluazifop-butyl	Fluazifop-p-acid	Fluazifop-acid
(1990) 92067033 (1990)		Supplemental for parent+acid[5,6] (DER 10/26/2003) Supplemental for all but the Speyer soils (DER 8/4/2008)	Calcareous clay loam, Gore Hill				Acid: 42 Parent + acid: 37-40[12] Parent+acid+unextracted: 315-330
			Loamy sand, Frensham				Acid: 34 Parent + Acid: 33[12] Parent+acid+unextracted: 112
			Fen peat, Rosedean				Acid: 54 Parent + Acid: 55[12] Parent+acid+unextracted: 385
			Coarse sand, Speyer 2.1				21-84
			Coarse sand, Speyer 2.2				> 168
			Loamy coarse sand, Speyer 2.3				21-84
87492 (1980)	Aerobic Soil	Not Classified (DER 5/3/1984)[6]	Coarse sandy loam	--	2 hours; unextractable phase not considered	--	--
			Coarse sand		1; unextractable phase not considered		
Negre *et al.* (1988)	Aerobic soil	Not used in modeling	Sandy loam	--	<1	--	--

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Media	Half-Life (days)			
				Fluazifop-p-butyl	Fluazifop-butyl	Fluazifop-p-acid	Fluazifop-acid
	Dry non-sterile soil	Not used in modeling	Sandy loam	--	17 (zero order)	--	--
Smith (1987)	Soil	Not used in modeling	Clay	--	< 2 days in all soils when the moisture was greater than 65% field capacity but >90% remained after 2 days in soils with < 20% moisture capacity	--	23
			Clay loam				21
			Sandy loam				11
46190602 (1998)	Aerobic soil	Supplemental[8] (DER 4/29/2005)	Silt loam	--	--	Linear = 10.5 Nonlinear DT50 = 8.3	--
			Sandy clay loam			Linear = 9.8 Nonlinear DT50 = 8.2	
			Sandy loam			Linear = 7.5 Nonlinear DT50 = 2.7	
			Sandy loam			Linear = 13.9 Nonlinear DT50 = 9.1	
			Sandy clay loam			Linear = 9.6 Nonlinear DT50 = 3.3	
			Clay loam			Linear = 9.1 Nonlinear DT50 = 2.3	

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Media	Half-Life (days)			
				Fluazifop-p-butyl	Fluazifop-butyl	Fluazifop-p-acid	Fluazifop-acid
Kah *et al.* (2007)	Aerobic Soil	Not used in modeling	Silty clay loam	--	--	6.0 ± 0.18[4]	--
			Sandy clay loam			6.1 ± 0.10	
			Sandy clay loam			10.3 ± 0.37	
			Sandy clay loam			6.3 ± 0.14	
			Sandy clay loam			11.3 ± 0.40	
			Sand			16.6 ± 0.76	
			Loam			7 ± 0.49	
			Clay			10.6 ± 0.80	
			Sandy loam			13 ± 0.92	
46190605 (1999)	Aerobic water-sediment	Acceptable (DER 04/26/2005)	Water/sand from England	--	--	Phenyl label 108 days (7-100 day data) Observed DT50 = 100	--
			Water/sandy loam system			Pyridyl label Linear = 13.7 Observed DT50=30-59	

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Media	Half-Life (days)			
				Fluazifop-p-butyl	Fluazifop-butyl	Fluazifop-p-acid	Fluazifop-acid
			from England			Phenyl label Linear=23.2 Observed DT50=30-59 Pyridyl label Linear = 43.9 Observed DT50=30-59	
87493 (1981) 92067032 (1990) 92067033 (1990)	Anaerobic flooded soil	Unacceptable for individual compounds (DER 10/26/1992) Supplemental for parent+acid (DER 10/28/2003)[6] Supplemental (DER 8/4/2008)	Sandy loam, 18 Acres Calcareous clay loam, Gore Hill	--	< 2 - 2	--	Acid: 866 Parent + acid: 289-315[12] Parent+acid+unextracted: 330-408 Parent + acid: 990-1155[12] Parent+acid+unextracted: 1155-1733
El-Metwally *et al.* (2007)	Terrestrial Field Dissipation	Not used in modeling	Clay loam from Egypt	4 -6	--	--	--
41598003 (1989)	Terrestrial Field Dissipation	Unacceptable[9] (DER 10/26/1992) Supplemental but does not fulfill guideline	Sandy loam planted with cotton from CA	--	1.5	--	18

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Media	Half-Life (days)			
				Fluazifop-p-butyl	Fluazifop-butyl	Fluazifop-p-acid	Fluazifop-acid
		(DER Addendum 8/12/2008)					
41598004 (1989)	Terrestrial Field Dissipation	Supplemental but does not fulfill guideline (DER 11/9/1992)	Sandy loam soil planted with cotton from CA	--	13	--	42
87495 (1981) 92067034 (1990)	Terrestrial Field Dissipation	Unacceptable[10] (DER 10/26/1992) Supplemental (DER Addendum 8/12/2008)	Loamy fine sand from NC Silty clay loam from IL Fine sandy loam from CA Silty loam from MS	--	<14 17 (0-3 inches) <7 <7 <7	--	5 17 (0-3 inches) 83 17 (0-3 inches) 18 17 (0-3 inches) 7 17 (0-3 inches)
41900605 (1989)	Terrestrial Field Dissipation	Unacceptable[9] (DER 10/26/1992) Supplemental but does not fulfill guideline (DER Addendum 8/12/2008)	Loam soil planted with cotton in CA	--	1.5	--	18
41900606 (1990)	Terrestrial Field Dissipation	Supplemental[11] (DER 11/9/1992)	Sandy loam soil planted with cotton	--	13	--	42

1 Abbreviations: DER = data evaluation record; DT50 = dissipation time of 50% of the chemical

2 If the values were from the open literature it does not have a study status because a standard classification method is not available for these studies. The results are reported because the information is still useful in describing the environmental fate of substances in the environment and an indication of whether the information is used in modeling is provided. Some studies completed prior 1985 have not been officially classified.

3 An EFED Fate summary dated 2/17/1982 estimated a half-life less than 2 days because that was the earliest sampling point after application, the data evaluation record (DER) completed on 10/26/1992 indicated the results supported a half-life of less than a day.

4 The values shown are the half-life ± the standard error.

5 Speyer soils from Germany were stored for one year prior to use which may have decreased the microbial populations present and thus degradation rates. These values were not upgraded to supplemental.

6 Soils were classified using the British classification system.

7 The study was determined to be unacceptable because 1) no attempt was made to reconcile the results of this study with the results of the photolysis on soil study (MRID 41598002) and an earlier aqueous photolysis study (MRID 93788); 2) no time zero sample was taken; 3) no data was provided to show that pH was constant; and 4) it was not explicit that wavelengths below 290 nm were filtered.

8 The study was classified as supplemental because a material balance was not completed and transformation products were not addressed (DER 04/29/2005).

9 These studies were previously classified as unacceptable because the plots were rototilled for weed control and, in some studies, residues could not be found or were found in much reduced levels after rototilling (DER 10/26/1992). The studies were upgraded to supplemental and the values may be considered a lower bound for rates of dissipation (DER Addendum No. 1 08/12/2008).

10 This study was previously classified as unacceptable because the sampling intervals were inadequate to accurately establish the half-life of the test substance, the application rate for parent fluazifop-butyl was not confirmed, and the analytical methods for determining the concentration of fluazifop-butyl and fluazifop-acid were not provided for review (DER 10/26/1992). The study was upgraded to supplemental and the values may be considered a lower bound for rates of dissipation (DER Addendum No. 1 08/12/2008).

11 The study was originally classified as unacceptable in part of the review and supplemental in another section because the dissipation of the degradate 5-trifluoromethyl-pyrid-2-one (degradate X) does not agree with the data reported in the aerobic metabolism and mobility laboratory studies (A. Abramovitch; EFED Fate Summary 11/9/1992; DP Barcode D157692, D157723, D165770). The study may be considered a lower bound for rates of dissipation.

12 The half-life was calculated using the linear/natural log equation.

3.2.1 Measures of Aquatic Exposure

3.2.1.1 Modeling Approach

Tier II modeling for selected scenarios representing labeled uses was used to generate estimated environmental concentrations (EECs). For Tier II, two models are used in tandem: the Pesticide Root Zone Model (PRZM) and the Exposure Analysis Modeling System (EXAMS). PRZM (3.12.2 dated May 12, 2005) simulates fate and transport on the agricultural field, and EXAMS (2.98.04.06, dated April 25, 2005) simulates the fate and resulting daily concentrations in the water body. Simulations are carried out with the linkage program shell (PE5, PE version 5, dated November 15, 2006), using the standard scenarios developed by EFED. Simulations are run for multiple (usually 30) years, and the EECs represent daily, 21-day average, and 60-day average peak values that are expected once every ten years based on the thirty years of daily values generated during the simulation. Additional information on these models can be found at: http://www.epa.gov/oppefed1/models/water/index.htm.

For aquatic endpoints, the exposure is estimated for the maximum application pattern to a 10-hectare (ha) field bordering a 1-hactare pond, 2-meter deep (20,000 m^3) with no outlet. Exposure estimates generated using this standard surface water body (the field is the EPA pond and the EXAMS environment is pond298.exv) are intended to represent a wide variety of vulnerable water bodies that occur at the top of watersheds including prairie pot holes, playa lakes, wetlands, vernal pools, man-made and natural ponds, and intermittent and first-order streams. As a group, there are factors that make these water bodies more or less vulnerable than the standard surrogate pond. Static water bodies that have larger ratios of drainage area to water body volume would be expected to have higher peak EECs than the standard pond. These water bodies will be either shallower or have large drainage areas (or both). Shallow water bodies tend to have limited additional storage capacity, and thus, tend to overflow and carry pesticide in the discharge whereas the standard pond has no discharge. As watershed size increases beyond 10 hectares, at some point, it becomes unlikely that the entire watershed is planted to a single crop, which is all treated with the pesticide. Headwater streams can also have peak concentrations higher than the standard pond, but they tend to persist for only short periods of time and are then carried downstream.

3.2.1.2 Model Inputs

For aquatic exposure, fluazifop-butyl was assumed to degrade to fluazifop-acid rapidly and EECs were estimated assuming application as fluazifop-acid. The appropriate PRZM and EXAMS input parameters for fluazifop-acid were selected from the environmental fate data submitted by the registrant and in accordance with US EPA-OPP EFED water model parameter selection guidelines, *Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of Pesticides*, Version II, February 28, 2002. Input parameters can be grouped by physico-chemical properties and environmental fate data, application information, and use scenarios.

Physical and chemical properties relevant to assess the behavior of fluazifop-acid in the environment are presented in Table 2-2 and application information from the label in Table 3-2.

The input parameters for PRZM and EXAMS are in Table 3-3. Appendix B contains the model output files and tables showing the data used to calculate input values.

Table 3-2. Summary of Application Information Used in PRZM/EXAMS to Estimate Surface Water EECs

Use Represented	Scenarios	Application Rate (kg a.i./ha)[1]	Application Rate (kg acid equivalents/ha)[2]	Maximum Number of Applications	Application Date (Day-Month)[3]	Application Interval (days)
Dry Beans	MIbeansSTD	0.21 and 0.42	0.18 and 0.36	4 and 2	07-06	14
	ILbeansNMC	0.21 and 0.42	0.18 and 0.36	4 and 2	23-06	14
	ORsnbeansSTD	0.21 and 0.42	0.18 and 0.36	4 and 2	23-06	14
	WAbeansNMC	0.21 and 0.42	0.18 and 0.36	4 and 2	23-06	14
Peanuts	NCpeanutSTD	0.21 and 0.42	0.18 and 0.36	4 and 2	23-05	14
Soybeans	MSsoybeanSTD	0.21 (prebloom) with 0.11 (postbloom) and 0.42 (prebloom) with 0.11 (postbloom)	0.21 (prebloom) with 0.09 (postbloom) and 0.36 (prebloom) with 0.09 (postbllom)	5 and 2	23-04	14, 14, 14, 49[4] 49

Abbreviations: ha=hectare; A=acre; a.i.=active ingredient

1 Calculated from lbs a.i./A using the following equation: (lbs a.i./A) x (1 kg/2.205 lbs) x (2.47 A/hectare)=kg a.i./A. The values reflect 0.19 lbs a.i./A, 0.38 lbs a.i./A, and 0.09 lbs a.i./A.

2 Calculated from kg a.i./ha using the following equation: kg a.i./ha x 327.26 g/mole fluazifop-acid divided by 383.37 g/mole fluazifop-butyl = kg acid equivalents/ha. The application rates were converted to acid equivalents for use in PRZM/EXAMS because fluazifop-butyl degrades rapidly in laboratory studies and exposure is modeled for fluazifop-acid.

3 Application date set to one week after crop emergence date in PRZM scenario.

4 The 14 day time interval was assumed based on the interval for dry beans and peanuts. Time between pre-bloom and bloom is approximately 7 weeks or 49 days (Thomas, J. G. and A. Blaine. Soybean Irrigation. Publication 2185. Extension Service of Mississippi State University, cooperating with United Stated Department of Agriculture (USDA). http://msucares.com/pubs/publications/p2185.htm).

Table 3-3. Summary of PRZM/EZAMS Environmental Fate Data Inputs Used to Estimate Surface Water Concentrations for Fluazifop-Acid.[1]

Fate Property	Value	MRID or Source, Comments
Molecular Weight	327.3 g/mole	From structure; calculated by EPI-Suite v3.12
Henry's constant	1.55×10^{-10} atm-m^3/mole	Calculated from vapor pressure (2.81×10^{-7}), solubility (780 mg/L), and molecular weight of fluazifop acid (327.26 g/mole) per input parameter guidance

Fate Property	Value	MRID or Source, Comments
Vapor Pressure	2.81x 10^{-7} torr	ChemIDplus Advanced, US National Library of Medicine Database available at: http://chem.sis.nlm.nih.gov/chemidplus/. Value shown is for fluazifop-acid (CAS No. 69335-91-7). Also estimated by EPI-Suite v3.12 (modified Grain method)
Solubility in water (pH 7, 20°C)	7800 mg/L	MRID 46190602; Water solubility x 10 per input parameter guidance
Soil Partition Coefficient, Kd	Lowest non sand K_F = 0.26 mL/g	MRID 41900604, 46190603; K_F values for fluazifop-p-acid and fluazifop-acid ranged from 0.14 to 38.5 L/kg and the coefficient of variation was smaller for K_F rather than K_{OC}, so the K_F values were used for input values (see Table B 4). Input parameter guidance recommends use of the average K_{OC} value when the value is predicted well by K_{OC} values; however, when sorption is not well predicted by the K_{OC} the lowest non sand K_d value is used.
Incorporation Depth	0 cm	Proposed label does not specify any incorporation (Fusilade®DX)
Application Rate	See Table 3-2	Proposed label (Fusilade®DX); The application rates were converted to acid equivalents for use in PRZM/EXAMS because fluazifop-butyl degrades rapidly in laboratory studies and exposure is modeled for fluazifop-acid.
Application Efficiency	0.99 (ground spray) 0.95 (aerial spray)	Input parameter guidance
Spray Drift Fraction	0.01 (ground) 0.05 (aerial)	Input parameter guidance
Application Date and Intervals	See Table 3-2	Proposed label (Fusilade®DX)
Application type	Foliar (CAM 2)	Foliar applications were modeled because the label recommends application to actively growing grasses.
Post-harvest Foliar Pesticide Disposition (IPSCND)	1 (surface applied)	Input parameter guidance
Photolysis in Water	0 days (stable)	No data for fluazifop-acid or fluazifop-p-acid
Hydrolysis	0 days (stable)	MRID 46190601
Aerobic Aquatic Metabolism (water column)	82 days	MRID 46190605; 90% upper confidence bound of the mean of four half-lives for fluazifop-p-acid, see Table B 2
Anaerobic Aquatic Metabolism (benthic)	0 days (stable)	MRID 87493, 92067032,92067033: 90% upper confidence bound of the mean of four anaerobic flooded soil half-lives was 1056 days, see Table B 3
Aerobic Soil Metabolism	30	MRID 46190602 and 87493, 92067032, 92067033. 90% upper confidence bound of the mean of 11 half-lives for fluazifop-p-acid and fluazifop-butyl · fluazifop-acid were used (see Table B 1). One supplemental value for a fen peat soil was not used because soybeans, dry beans, and peanuts are not expected to be grown on fen peat soils.
Plant uptake factor (UPTKF)	No input	Input parameter guidance

Fate Property	Value	MRID or Source, Comments
Foliage Pesticide Volatization (PLVKRT)	No input	Input parameter guidance
Foliage Pesticide First-Order Decay (PLDKRT)	No input	Input parameter guidance
Foliar Wash-Off Extraction Efficiency (FEXTRC)	0.5	Input parameter guidance
Runoff Flow	None	Input parameter guidance

[1] Inputs determined in accordance with EFED "*Guidance for Chemistry and Management Practice Input Parameters for Use in Modeling the Environmental Fate and Transport of Pesticides*" dated February 28, 2002.

Scenarios are used to input soil, climatic, and agronomic data, chosen to result in a high-end exposure setting for a particular crop or pesticide use within a geographic region, into PRZM/EXAMS. Each PRZM scenario is specific to a location. Soil and agronomic data specific to the location are available in the scenario and a specific climatic weather station providing 30 years of daily weather values is associated with that location. See Appendix B for the station chosen for each scenario. Table 3-4 summarizes the PRZM scenario name and location used to estimate EECs for fluazifop-acid. The scenarios model use on dry beans in Michigan, Illinois, Oregon, and Washington, use on peanuts in North Carolina, and use on soybeans in Mississippi.

Table 3-4. PRZM/EXAMS Scenarios Used to Estimate Concentrations of Fluazifop-Acid in the Aquatic Environment.[1]

Modeling Scenario	Uses Represented	Location Modeled	Soil	Hydrologic Group of Soil (SCS Curve Number)
MIbeansSTD	Dry Beans	Bay thumb region of Michigan	Toledo silty clay	D (92, 89, 90)
ILbeansNMC	Dry Beans	McLean County, Illinois	Silt loam	Not specified (82, 85, 87)
ORsnbeansSTD	Dry Beans	Marion County, Oregon	Dayton silt loam	D (92, 89, 90)
WAbeansNMC	Dry Beans	Grant County, Washington	Ekrub fine sand	C (84, 86, 87)
NCpeanutSTD	Peanuts	Eastern Pitt County, North Carolina	Craven silt loam	C (89, 84, 86)
MS Soybean STD	Soybeans	Yazoo County, Mississippi	Loring silt loam	C (87, 84, 86)

1 Information on the scenarios was obtained from *Pesticide Root Zone Model Field and Orchard Crop Scenario Metadata (*April 5, 2006) and *Pesticide Root Zone Model Field and Orchard Crop Metadata for NMC Scenarios* (April 5, 2006) available at http://www.epa.gov/oppefed1/models/water/ under the PE Version 5.0 Documentation.

3.2.1.3 Estimated Exposure Concentrations in Surface Water

Table 3-5 summarizes the Tier II aquatic exposure modeling results for exposure in surface water with EECs estimated for the water column. The output from aquatic exposure modeling is provided in Appendix B. PRZM/EXAMS EECs reflect daily, 21-day average, and 60-day average peak (one in ten year return frequency) surface water concentrations for aerial and ground applications to dry beans, peanuts, and soybeans.

Surface water EECs for the water column ranged from 1.35 – 14.30μg/L for fluazifop-acid. The highest EECs were predicted in the Illinois scenario for dry beans.

Table 3-5. Estimated Environmental Concentrations of Fluazifop-acid in Surface Water using the PRZM/EXAMS model

Use Represented	Scenario	Application Rate (kg acid equivalents/ha)[2]	Number of Applications[3]	Estimated Environmental Concentrations (EECs) (μg/L)[1]		
				Daily	21-day	60-day
Aerial						
Dry Beans	MIbeansSTD	0.18	4	8.58	8.28	7.58
		0.36	2	10.51	9.82	8.73
	ILbeansNMC	0.18	4	6.64	6.63	6.59
		0.36	2	14.30	13.32	11.72
	ORsnbeansSTD	0.18	4	7.64	7.47	7.15
		0.36	2	6.50	6.25	5.84
	WAbeansNMC	0.18	4	2.83	2.69	2.53
		0.36	2	3.06	2.88	2.63
Peanuts	NCpeanutSTD	0.18	4	6.35	6.04	5.26
		0.36	2	5.87	5.54	4.84
Soybean	MS Soybean STD	0.18 with 0.09 on last application.	5	8.51	8.06	7.09
		0.36 and 0.09	2	5.22	4.89	4.41
Ground						
Dry Beans	MIbeansSTD	0.18	4	7.34	6.97	6.44
		0.36	2	9.06	8.47	7.54
	ILbeansNMC	0.18	4	11.20	10.57	10.04
		0.36	2	12.97	12.26	10.81
	ORsnbeansSTD	0.18	4	6.82	6.67	6.39
		0.36	2	5.34	5.13	4.79
	WAbeansNMC	0.18	4	1.56	1.54	1.49
		0.36	2	1.35	1.26	1.16
Peanuts	NCpeanutSTD	0.18	4	5.30	4.91	4.22
		0.36	2	4.41	4.16	3.63

Use Represented	Scenario	Application Rate (kg acid equivalents/ha)[2]	Number of Applications[3]	Estimated Environmental Concentrations (EECs) (µg/L)[1]		
				Daily	21-day	60-day
Soybean	MSSoybean STD	0.18 with 0.09 on last application.	5	7.56	7.06	6.13
		0.36 and 0.09	2	4.58	4.29	3.83

1 Surface water concentrations represent the daily or 24-hour, 21-day average, and 60-day average peak surface water concentration based on a one in ten year return frequency.

3.2.1.4 Aquatic Exposure Monitoring and Field Data

Fluazifop-butyl has been detected in both river water and ground water samples at concentrations less than 0.2 parts per billion (ppb). This indicates that there is a potential for fluazifop-butyl to reach surface and ground waters; however, it is not expected to persist as fluazifop-butyl. This is supported by monitoring results that only detected fluazifop-butyl in the time frame that it was expected to be used (Martinez *et al.* 2000). Fluazifop-acid was not detected in a non-targeted ground water monitoring study completed in Germany (MRID 40439401); however, the fluazifop-butyl results indicate that fluazifop-acid also has the potential to be found in groundwater samples as it is the primary degradate of fluazifop-butyl and it is more stable than the parent. The limited monitoring results available are summarized below.

- Fluazifop-butyl was detected in 27% (five out of 18) samples of river water in the Guarena and Almar river basins in Spain and 13% (three of twenty three) samples of ground water (Martinez *et al.* 2000). All detections of fluazifop-butyl occurred in the sampling period when fluazifop-butyl was expected to be used on lentils and chickpeas in the area sampled. When the sampling time was targeted to when fluazifop-butyl was used, it was detected in 56% of (five out of nine) river water samples at the detection limit to 0.20 µg/L and 20% (three of 15) of ground water samples at the detection limit to 0.18 µg/L.[1]
- In a regional groundwater monitoring program conducted in Northern Ireland, fluazifop-p-butyl was detected in one of 82 ground water samples at a concentration of 0.0041 µg/L (Scott and McConvey 2005).
- A groundwater survey was completed in West Germany that analyzed 605 water samples from 95 raw water wells (MRID 40439401). No residues of fluazifop-acid were found (limit of detection was 0.00008 mg/L).
- Fusilade was detected in three samples from community drinking water wells in McFarland and Kern County, California at concentrations of 0.06, 0.16, and 0.17 µg/L (ATSDR 2001).
- Fluazifop-butyl was listed in the USEPA STORET database and was reported as not detected in 553 ground water samples collected between 1991 and 2002 by the Arizona Department of Environmental Quality (USEPA STORETv2.0 Database; available at http://www.epa.gov/storet/dw_home.html).

[1] Fluazifop-butyl usage was expected to occur between April and June and the samples collected between June and September (Martinez *et al.* 2000). Samples collected between October and December did not detect residues of fluazifop-butyl.

The United States Geological Survey (USGS) National Water-Quality Assessment (NAWQA) Program Data Warehouse (available at http://infotrek.er.usgs.gov/traverse/f?p=NAWQA:HOME:1405517206944567) and the California Department of Pesticide Regulation (DPR) Surface Water Database (available at http://www.cdpr.ca.gov/docs/emon/surfwtr/surfdata.htm) were searched for monitoring information on fluazifop-butyl and fluazifop-acid. No monitoring information was found.

3.2.2 Measures of Terrestrial Exposure

Avian and Mammalian Exposure

Terrestrial wildlife exposure estimates are typically calculated for bird and mammals, emphasizing a dietary exposure route for uptake of pesticide active ingredients. These exposures are considered as surrogates for terrestrial-phase amphibians as well as reptiles. For exposure to terrestrial organisms, such as birds and small mammals, pesticide residues on food items are estimated, based on the assumption that organisms are exposed to a single pesticide residue in a given exposure scenario.

Birds and mammals in the field may be exposed to fluazifop-p-butyl by ingesting material directly with the diet. They also may be exposed by other routes, such as incidental ingestion of contaminated soil, dermal contact with treated surfaces and soil during activities in the treated areas, preening activities, and ingestion of drinking water contaminated with pesticide. Only ingestion of treated food items was considered as a route of exposure in this assessment. However, it is assumed that 100% of the daily dietary requirements are from the treated field which is may be conservative.

Terrestrial Estimated Environmental Concentrations (EEC's) and acute risk quotient (RQ) values were calculated for the purposes of assessing risk from fluazifop-p-butyl using the acute oral dose for toxicity (LD_{50}), and comparing it to the available concentration of pesticide expected on food items. The T-REX model (v1.3.1, USEPA, 2005a) was used to estimate the terrestrial animal exposure values resulting from possible dietary ingestion of fluazifop-p-butyl residues on vegetative matter and insects. The EEC values were calculated based on the default foliar dissipation half-life of 35 days for the parent and degradates due to the lack of foliar dissipation data. The terrestrial EECs were calculated based on the proposed maximum label application rates. For the proposed soybean application rate, T-REX analysis showed that the EEC's for the two applications were highest after the original application of 0.375, therefore this value was used to calculate RQ's for terrestrial species. The default half life value of 35 days was selected in the absence of dissipation data. The predicted maximum residues of fluazifop-p-butyl that may be expected to occur on selected avian or mammalian food items immediately following application are presented in Table 3-6.

Table 3-6. EECs of Fluazifop Residues on Terrestrial Dietary Items

Initial /Follow-up Application Rate (lb ai/acre)	Number of Applications @ interval (day)	EEC (ppm)			
		Short grass	Tall grass	Broadleaf plants/ small insects	Fruits/pods/ large insects
Peanuts and Dry Beans 0.375/0.375	**2(14)**	39.28	18.00	22.09	2.45
Soybeans 0.375/0.094	**2(49)**	90	41.25	50.63	5.63

Terrestrial Plants

There are no data regarding the explicit toxicity of fluazifop-p-butyl to terrestrial plants. Therefore, no modeling of exposure for soil or foliar residues for terrestrial and semi-aquatic plants was performed.

3.3 Ecological Effects Characterization

In screening-level ecological risk assessments, effects characterization describes the types of effects a pesticide can produce in an organism or plant. This characterization is based on registrant-submitted studies that describe acute and chronic effects toxicity information for various aquatic and terrestrial animals and plants. The most sensitive species were selected from the available data and were used in this analysis. All acceptable or supplemental guideline study data for fluazifop formulations and degradates are summarized in Appendix C.

3.3.1 Terrestrial Effects Characterization

3.3.1.1 Terrestrial Animals

Birds and Mammals

The most sensitive avian acute and chronic toxicity test results selected for use in assessing baseline risk from fluazifop-p-butyl are summarized in Table 3-7; see Appendix C for all test data results. In birds, the acute oral LD_{50} for *Anas platyrhynchos* is >5,000 mg/kg-bw and the 8-d (5-d exposure and 3-d post-exposure) avian dietary LC_{50} value for *Phasianus colchicus* is 20,767 ppm, both practically nontoxic. The avian reproductive toxicity NOAEL for a *Colinus virginianus* study and an *A. platyrhynchos* study are both ≥50 ppm (*e.g.*, the highest exposure level tested did not result in any reproductive effect, or loss of weight or growth in adults or chicks). In laboratory rats, fluazifop-p-butyl has a dose based acute toxicity LD_{50} value of 1940 mg/kg-bw (slightly toxic) and a 2-generation reproductive NOAEL value of 0.74 ppm.

Table 3-7. Summary of Acute and Chronic Toxicity Data for Birds and Mammals Exposed to Fluazifop

Parameter	Study Type	Species	Exposure Duration	Toxicity Value	Reference (Study Classification)
Abundance (i.e., survival, reproduction, and growth) of individual birds and mammals	**Birds**				
	Acute (Dose-based)	Mallard (*Anas platyrhynchos*)	Single oral dose	LD_{50} >3528mg/kg-bw	40829201 Acceptable
	Acute (Dose-based)	Mallard (*Anas platyrhynchos*)	Single oral dose	LD_{50} >5000mg/kg-bw	00131457 Acceptable
	Acute (Dietary-based)	Pheasant (*Phasianus colchicus*)	8-day (5 d exposure, 3 d post) dietary	LC_{50} 20,767ppm	00087482 Acceptable
	Chronic (Dose-based)	Bobwhite quail (*Colinus virginianus*)	Avian reproduction study, 31 week	NOAEL ≥50 ppm	00093802 (Supplemental)
	Chronic (Dietary-based)	Mallard (*Anas platyrhynchos*)	Avian reproduction study, 23 week	NOAEL ≥50 ppm	00093801 (Supplemental)
	Mammals				
	Acute (Dose-based)	Rat (*Rattus norvegicus*)	Single oral dose	LD_{50} 1940 mg a.i./kg-bw (	00162439 Acceptable
	Chronic (Dietary-based)	Rat (*Rattus norvegicus*)	2-Generation reproduction study	0.74 ppm a.i (NOAEL)	92067050 Acceptable

Terrestrial Invertebrates

Fluazifop-p-butyl is practically non-toxic to the Honey Bee with the lowest acute contact LD_{50} of 63 µg/bee. The most sensitive honey bee toxicity data value is summarized in Table 3-8, see Appendix C for all honey bee testing data.

Table 3-8. Summary of Selected Acute Toxicity Data for Honey Bee Exposed to Fluazifop

Parameter	Study Type	Species	Exposure Duration	Toxicity Value	Reference (Study Classification)
Abundance (i.e., survival, reproduction, and growth) of beneficial insects	Acute Dermal Contact	Honey bee (*Apis mellifera*)	24 hr	LD_{50} 63 µg ai/Bee 491ppm[a]	00162453 Acceptable

[a] Based on Honey Bee (*Apis mellifera*) Toxicity Value 63.0 µg/individual, assuming an average fresh weight per honey bee of 128 milligrams. The LD_{50} of honey bees was multiplied by 7.8 to determine the value based on a ppm toxicity for use with TREX residues on dietary items.

3.3.1.2 Terrestrial Plants

No toxicity data have been submitted regarding the toxicity of fluazifop-p-butyl to plants. Dicot plants are presumed to not be affected at the application rate due to the fact that it is used routinely on dicot plant crops and no incidents of damage to these species have been reported.

Effects to monocots at the application rate is presumed as this is its purpose and to algae and effects to lichens at application rates are also presumed in the absence of data.

3.3.2 Aquatic Effects Characterization

3.3.2.1 Aquatic Animals

Aquatic toxicity data were measured for the parent compound for a number of aquatic species; see Appendix C. These values were converted to acid equivalent values to allow comparison to the surface water EECs modeled for fluazifop-acid. The most sensitive of the acute and chronic values are summarized in Table 3-9. The Pacific Oyster (*Crassostrea gigas*), with a 48-h EC_{50} value for embryo/larval survival and development of 0.083 mg acid equivalents (ae)/L was the most acutely sensitive of the aquatic organisms tested. Fluazifop-p-butyl is considered very highly toxic to mollusks, both freshwater and saltwater based on this result. Fluazifop-p-butyl is also considered very highly toxic to freshwater fish, other freshwater invertebrates, and estuarine/marine fish.

Chronic toxicity tests were submitted for both a freshwater and estuarine/marine invertebrate species, and for a freshwater fish species. The most chronically sensitive species was the estuarine/marine invertebrate *A. bahia* with a 28-d reproduction NOAEC of 0.0148 mg ae/L. The *D. magna* 21-d reproduction NOAEC value of 0.0854 mg ae/L while slightly higher is of similar sensitivity. The freshwater fathead minnow value 30-d early life stage NOAEC value of $\geq$0.203 mg ae/L was less sensitive than the invertebrates. Acceptable chronic toxicity data for estuarine/marine fish have not been submitted to the Agency. However, an ACR value calculated for the freshwater fish *P. promelas* of 1.6[1] was used to extrapolate an early life stage NOAEC of >0.0043 mg ae/L from the acute 96-h LC_{50} value available for *C. variegatus*. ACR values for crustaceans[2] ranged from 12.4 for *A. bahia* to 5,538 for *D. magna*. Aquatic animal toxicity data used in this assessment are listed in Table 3-9.

Table 3-9. Summary of Acute and Chronic Toxicity Data for Aquatic Animals Exposed to Fluazifop

Parameter	Study Type	Species	Exposure Duration	Toxicity Value	Reference (Study Classification)
Survival and reproduction of freshwater fish and invertebrates	**Freshwater Fish**				
	Acute	Fathead minnow (*Pimephales promelas*)	96 hours	0.32 mg acid-equiv./L (0.37 mg a.i. /L.) (LC_{50})	00087485 (Acceptable)

[1]Fish ACR = *P. promelas* 96-h LC_{50}/ *P. promelas* early-life stage NOAEC = 0.32 ppm ae/$\geq$0.203 ppm ae = $\leq$1.6; estimated *C. variegatus* NOAEC = *C. variegatus* 96-h LC_{50}/fish ACR = 6.86/$\leq$1.6 = $\geq$4.3 ppm ae.

[2] *D magna* ACR = 48-h EC_{50}/life cycle NOAEC = 5.14ppm/0.0854ppm = 60 to *D magna* ACR = 48-h EC_{50}/life cycle NOAEC = 473,000 ppm/0.0854ppm = 5,538; *Americamysis bahia* ACR = 96-h LC_{50}/life cycle NOAEC = 0.184 ppm/0.0148 ppm = 12.4 to *Americamysis bahia* ACR = 96-h LC_{50}/life cycle NOAEC = 0.440 ppm/0.0148 ppm = 29.7

Parameter	Study Type	Species	Exposure Duration	Toxicity Value	Reference (Study Classification)
	Chronic	Fathead Minnow (*P. promelas*)	30 days	$\geq$0.203 mg acid-equiv. /L ($\geq$0.283 mg a.i. /L a.i.) (NOAEC)	00093808 (Acceptable)
	Freshwater Invertebrates				
	Acute	Water flea (*Daphnia magna*)	48 hours	*5.14 mg acid-equiv. /L (6.02 mg/L a.i.) (EC_{50})	00087489 (Acceptable)
	Chronic	Water flea (*Daphnia magna*)	21 day Life Cycle	0.0854 mg acid-equiv./L (0.100 mg/L a.i.) (NOAEC)	00093807 (Supplemental)
4. Survival and reproduction of estuarine/marine fish and invertebrates	**Estuarine/Marine Fish**				
	Acute	Sheepshead Minnow (*Cyprinodon variegatus*)	96 hours	6.86 mg acid-equiv./L (8.04 mg/L a.i. (LC_{50})	00152173 (Supplemental)
	Chronic	Extrapolated Sheepshead Minnow value	Extrapolated early life stage test	$\geq$4.3 acid-equiv./L (NOAEC derived from fish ACR of $\leq$1.6 and Sheepshead acute value above)	--
	Estuarine/Marine Invertebrates				
	Acute	Pacific Oyster (*Crassostrea gigas*)	48 hours	0.083 acid-equiv./L (0.097 mg/L a.i. (EC_{50} for survival and development of embryo/larval stage)	ACC 251454 (Acceptable)
	Chronic	Mysid (*Americamysis bahia*)	28 day Reproduction Test	0.0148 mg acid-equiv./L (0.0174 mg/L) (NOAEC)	00093805, 1981 (Supplemental)

*The Pacific oyster 48-hr acute value will be used to assess acute risks to freshwater mollusks because it is lower than the acute freshwater invertebrate data, which is available only for crustaceans.

3.3.2.2 Aquatic Plants

There was one aquatic plant test with fluazipfop-p-butyl; it was with the freshwater green alga *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricornutum*). It provides a 4-d IC_{50} value of >1.5 mg ae/L (>1.8 mg ai/L) and a NOAEC of 0.75 mg ae/L (0.88 mg ai/L) (MRID 41900603). The study is classified as supplemental.

4.0 Risk Characterization

Risk characterization is the integration of exposure and effects characterization to determine the ecological risk from the use of fluazifop-p-butyl and the likelihood of effects on aquatic life, wildlife, and plants based on varying pesticide-use scenarios. The risk characterization provides estimation and a description of the risk; articulates risk assessment assumptions, limitations, and uncertainties; synthesizes an overall conclusions; and provides the risk managers with information to make regulatory decisions.

4.1 Risk Estimation – Integration of Exposure and Effects Data

Results of the exposure and toxicity effects data are used to evaluate the likelihood of adverse ecological effects on non-target species. For the assessment of fluazifop-p-butyl risks, the risk quotient (RQ) method is used to compare exposure and measured toxicity values. Estimated environmental concentrations (EECs) are divided by acute and chronic toxicity values. The RQ's are compared to the Agency's levels of concern (LOCs). These LOCs are the Agency's interpretive policy and are used to analyze potential risk to non-target organisms and the need to consider regulatory action. These criteria are used to indicate when a pesticide's use as directed on the label has the potential to cause adverse effects on non-target organisms. The LOC's are listed in Appendix D.

4.1.1 Non-target Aquatic Animals and Plants

Surface water concentrations resulting from fluazifop-p-butyl application were predicted with the Tier II models PRZM-EXAMS. These aquatic Estimated Environmental Concentrations (EEC's) are listed in Table 3-5. Peak EECs were then compared to acute toxicity endpoints to derive acute RQ's. The 60- day EECs were compared to chronic toxicity endpoints (NOAEC values) to derive chronic RQ's for fish, and 21-day EECs were compared to chronic toxicity endpoints for aquatic invertebrates. Acute RQ's for freshwater and estuarine/marine organisms for different exposure scenarios are presented in Table 4-1 and chronic RQ's for these species are presented in Table 4-2.

Table 4-1. Acute risk quotients for fish and invertebrates exposed to fluazifop-acid in the water column from proposed new uses[†].

SCENARIO				Acute Risk Quotients				
				Freshwater			Estuarine/Marine	
Application Type and Crop		Crop Scenario	Application Rate (lbs ai/A)	Fish[a]	Mollusks[b]	Other Invertebrates[c]	Fish[d]	Invertebrates[e]
Aerial	Dry Beans	MI beans STD	0.18	0.03	0.10*	<0.01	<0.01	0.10*
			0.36	0.03	0.13*	<0.01	<0.01	0.13*
		IL beans NMC	0.18	0.02	0.08*	<0.01	<0.01	0.08*
			0.36	0.04	0.17*	<0.01	<0.01	0.17*
		OR snbeans STD	0.18	0.02	0.09*	<0.01	<0.01	0.09*
			0.36	0.02	0.08*	<0.01	<0.01	0.08*
		WA beans NMC	0.18	<0.01	0.03	<0.01	<0.01	0.03
			0.36	<0.01	0.04	<0.01	<0.01	0.04
	Peanuts	NC peanut STD	0.18	0.02	0.08*	<0.01	<0.01	0.08*
			0.36	0.02	0.07*	<0.01	<0.01	0.07*
	Soybean	MS Soybean STD	0.18/ 0.09**	0.03	0.10*	<0.01	<0.01	0.10*
			0.36/ 0.09***	0.02	0.06*	<0.01	<0.01	0.06*

SCENARIO				Acute Risk Quotients				
				Freshwater			Estuarine/Marine	
Application Type and Crop		Crop Scenario	Application Rate (lbs ai/A)	Fish[a]	Mollusks[b]	Other Invertebrates[c]	Fish[d]	Invertebrates[e]
Ground	Dry Beans	MI beans STD	0.18	0.02	0.09*	<0.01	<0.01	0.09*
			0.36	0.03	0.11*	<0.01	<0.01	0.11*
		IL beans NMC	0.18	0.04	0.13*	<0.01	<0.01	0.13*
			0.36	0.04	0.16*	<0.01	<0.01	0.16*
		OR snbeans STD	0.18	0.02	0.08*	<0.01	<0.01	0.08*
			0.36	0.02	0.06*	<0.01	<0.01	0.06*
		WA beans NMC	0.18	<0.01	0.02	<0.01	<0.01	0.02
			0.36	<0.01	0.02	<0.01	<0.01	0.02
	Peanuts	NC peanut STD	0.18	0.02	0.06*	<0.01	<0.01	0.06*
			0.36	0.01	0.05*	<0.01	<0.01	0.05*
	Soybean	MS Soybean STD	0.18/ 0.09**	0.02	0.09*	<0.01	<0.01	0.09*
			0.36/ 0.09***	0.01	0.06*	<0.01	<0.01	0.06*

†Bolded RQ values exceed the Agency's acute LOC (0.5) for direct effects to non-listed species (none)
* RQ values exceed the Agency's endangered acute LOC (0.05) for listed species
** There are five applications per season (rate for first four/rate for last).
*** There are two applications per season (rate for first/rate for second).
[a] Based on Fathead minnow (*P. promelas*) 96-h LC_{50} = 320 ppb ae
[b] When the acute estuarine/marine mollusk value is more sensitive than freshwater invertebrate data with no freshwater mollusk test results, the estuarine/marine mollusk data is used to assess risk to freshwater mollusks. Therefore, this acute value is based on Pacific Oyster (*C. gigas*) 48-h EC_{50} = 83 ppb ae
[c] Based on Water Flea (*D. magna*) 48-hr LC_{50} = 5,140 ppb ae
[d] Based on Sheepshead Minnow (*C. variegatus*) 96-h LC_{50} = 6,860 ppb ae
[e] Based on Pacific Oyster (*C. gigas*) 48-h EC_{50} = 83 ppb ae

Table 4-2. Chronic risk quotients for fish and invertebrates exposed to fluazifop in the water column from proposed new uses†

SCENARIO				Chronic Risk Quotients			
				Estuarine/Marine		Freshwater	
Application Type and Crop		Crop Scenario	Rate (lbs ai/A)	Fish[a]	Invertebrates[b]	Fish[c]	Invertebrates[d]
Aerial	Dry Beans	MI beans STD	0.18	<0.1	0.6	<0.1	<0.1
			0.36	<0.1	0.7	<0.1	0.1
		IL beans NMC	0.18	<0.1	0.4	<0.1	<0.1
			0.36	<0.1	0.9	<0.1	0.2
		OR snbeans STD	0.18	<0.1	0.5	<0.1	<0.1
			0.36	<0.1	0.4	<0.1	<0.1
		WA beans NMC	0.18	<0.1	0.2	<0.1	<0.1
			0.36	<0.1	0.2	<0.1	<0.1
	Peanuts	NC peanut STD	0.18	<0.1	0.4	<0.1	<0.1
			0.36	<0.1	0.4	<0.1	<0.1
	Soybean	MS Soybean STD	0.18/ 0.09	<0.1	0.5	<0.1	<0.1
			0.36/ 0.09	<0.1	0.3	<0.1	<0.1

SCENARIO				Chronic Risk Quotients			
				Estuarine/Marine		Freshwater	
Application Type and Crop		Crop Scenario	Rate (lbs ai/A)	Fish[a]	Invertebrates[b]	Fish[c]	Invertebrates[d]
Ground	Dry Beans	MI beans STD	0.18	<0.1	0.5	<0.1	<0.1
			0.36	<0.1	0.6	<0.1	<0.1
		IL beans NMC	0.18	<0.1	0.7	<0.1	0.1
			0.36	<0.1	0.8	<0.1	0.1
		OR snbeans STD	0.18	<0.1	0.5	<0.1	<0.1
			0.36	<0.1	0.3	<0.1	<0.1
		WA beans NMC	0.18	<0.1	0.1	<0.1	<0.1
			0.36	<0.1	0.1	<0.1	<0.1
	Peanuts	NC peanut STD	0.18	<0.1	0.3	<0.1	<0.1
			0.36	<0.1	0.3	<0.1	<0.1
	Soybean	MS Soybean STD	0.18/ 0.09	<0.1	0.5	<0.1	<0.1
			0.36/ 0.09	<0.1	0.3	<0.1	<0.1

[†]Bolded RQ values exceed the Agency's chronic LOC (1.0)
[a] Based on *C. variegates* extrapolated early life stage NOAEC of ≥4,300 ppb ae
[b] Based on *M. bahia* reproduction NOAEC = 14.8 ppb ae
[c] Based on Fathead Minnow *(P. promelas)* early life stage NOAEC of ≥203 ppb ae
[d] Based on Water Flea (*D. magna*) reproduction NOAEC of 85.4 ppb ae

4.1.1.1 Non-target Aquatic Animals

Acute Risk

The Agency's acute endangered LOC value (0.05) was met or exceeded for acute risks to estuarine/marine invertebrates and for freshwater mollusks for all proposed applications except both ground and aerial applications under the WA beans scenario. The Agency's acute LOC value was not exceeded for either freshwater or estuarine/marine fish or crustaceans.

Chronic Risk

The Agency's chronic LOC value (1.0) was not exceeded for any aquatic organisms based on fish and crustacean toxicity results. While a mollusk was the most acutely sensitive species tested, there is no comparable chronic value for a mollusk species. However, the 48-hr mollusk embryo/larval NOAEC for effects on survival and normal development is higher than estimate exposure levels.

4.1.1.2 Aquatic Plants

There was one aquatic plant test with fluazipfop-p-butyl; it was with the freshwater green alga *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricornutum*). It provides a 4-d IC_{50} value of >1.5 mg ae/L (>1.8 mg ai/L) and a NOAEC of 0.75 mg ae/L (0.88 mg ai/L) (MRID 41900603). As both these values are higher than estimated exposure concentrations, no effect on this algal species is expected.

4.1.1.3 Non-target Terrestrial Animals

Residues in potential dietary sources (*e.g.*, vegetation and insects) for terrestrial insects, mammals and birds were estimated using the Tier I model T-REX Version 1.3.1. This model provides estimates of concentrations (maximum, or upper bound, and average) of chemical residues on the surfaces of different types of foliage that may be sources of dietary exposure to avian, mammalian, reptilian, or terrestrial-phase amphibian receptors. The surface residue concentration (ppm) is estimated by multiplying the application rate (pounds active ingredient per acre) by a value specific to each food item. For both mammals and birds, three animal body weight classes are considered. The RQ's for terrestrial invertebrates are summarized in Table 4-3, avian species are summarized in Table 4-4 and mammalian RQ's are summarized in Table 4-5. T-REX analyses are presented in Appendix E.

Table 4-3. Terrestrial invertebrate risk quotients for proposed aerial applications of fluazifop-p-butyl

Initial /Followup Application Rate (lb ai/acre)	Number of Appli. @ interval (day)	Food Item	Acute RQ[a]
Peanuts and Dry Beans 0.375/0.375	2(14)	Short Grass	<0.01
		Tall Grass	<0.01
		Broadleaf plants/small insects	<0.01
		Fruits/pods/large insects	<0.01
Soybeans 0.375/0.094	2(49)	Short Grass	<0.01
		Tall Grass	<0.01
		Broadleaf plants/small insects	<0.01
		Fruits/pods/large insects	<0.01

*Bolded values exceed the Agency's endangered LOC for terrestrial invertebrates (LOC = 0.05) – none exceed

[a] Based on acute contact LD_{50} = 491.0 ppm derived from Honey Bee (*Apis mellifera*) LD_{50} value of 63.0 µg/individual, assuming an average fresh weight per honey bee of 128 milligrams. The LD_{50} of honey bees was multiplied by 7.8 to determine the ppm toxicity.

Table 4-4. Avian risk quotients for proposed aerial applications of fluazifop-p-butyl[†]

Initial /Followup Application Rate (lb ai/acre)	Number of Appli. @ interval (day)	Food Item	Acute Dietary-based RQ[a,b]	Chronic Dietary-based RQ[c]
Peanuts and Dry Beans 0.375/0.375	2(14)	Short Grass	<0.01	<0.8
		Tall Grass	<0.01	<0.4
		Broadleaf plants/small insects	<0.01	<0.4
		Fruits/pods/large insects	<0.01	<0.1
Soybeans 0.375/0.094	2(49)	Short Grass	<0.01	<1.8
		Tall Grass	<0.01	<0.8
		Broadleaf plants/small insects	<0.01	<1.0
		Fruits/pods/large insects	<0.01	<0.1

[†] Bolded values exceed the Agency's chronic LOC (1.0) – none exceed

[a] Acute-dosed based numbers were not calculated because the highest concentration tested (5000 mg/kg-bw) did not produce any toxicant related toxicity. Because dose-based residue values are below this level no acute effects are expected.

[b] Based on Pheasant (*Phasianus colchicus*) dietary 8-d LC_{50} = 20,767 ppm

[c] Based on Bobwhite quail (*Colinus virginianus*) and Mallard Duck (*Anas platyrhynchosi*) NOAEC ≥50 ppm

Table 4-5. Mammalian risk quotients for proposed aerial applications of fluazifop-p-butyl[†]

Initial /Followup Application Rate (lb ai/acre)	Number of Appli. @ interval (day)	Food Item	Acute Dose-based RQ[a]	Chronic Dietary-based RQ[c]
Peanuts and Dry Beans 0.375/0.375	2(14)	Short Grass	<0.01	**2.6**
		Tall Grass	<0.01	**1.2**
		Broadleaf plants/small insects	<0.01	**1.5**
		Fruits/pods/large insects	<0.01	0.2
		Seeds	<0.01	--
Soybeans 0.375/0.094	2(49)	Short Grass	0.02	**6.1**
		Tall Grass	<0.01	**2.8**
		Broadleaf plants/small insects	0.01	**3.4**
		Fruits/pods/large insects	<0.01	0.4
		Seeds	<0.01	--

[†]Bolded values exceed the Agency's chronic LOC (1.0)

[a] Based on Norway Rat (*Rattus norvegicus*) LD_{50} = 1940 mg/kg-bw

[b] Based on Norway Rat (*Rattus norvegicus*) 2-generation reproduction NOAEC= 14.8 ppm

Acute Avian Risk

No acute risks are expected for avian species, or terrestrial-phase amphibians for which they are surrogates, from the proposed new uses of fluazifop-p-butyl. Acute dietary based risk quotients were 0.04 or less for all proposed uses and did not exceed the Agency's LOC for listed (LOC = 0.1) or non-listed (LOC = 0.5) birds. Acute-dosed based numbers were not calculated because the highest concentration tested (5000 mg/kg-bw) did not produced any toxicity. Because dose-based residue values are below this level no acute effects are expected.

Chronic Avian Risk

RQ values using the highest level tested resulted in no exceedences of the chronic LOC (1.0) for the Peanut and Dry Bean scenarios. Potentially the RQ values slightly exceed the Agency's LOC for birds feeding on short grass (RQ $\leq$1.8) when using the highest NOAEC value tested.

Acute Mammalian Risk

No acute risks are expected for mammalian species from the proposed new uses of fluazifop-p-butyl. Acute risk quotients did not exceed the Agency's LOC of 0.5 for non-listed and 0.1 for listed terrestrial mammals for any of the proposed uses of fluazifop-p-butyl.

Chronic Mammalian Risk

Dose based data show that chronic RQ values exceed the Agency's chronic LOC for mammals feeding on short grass, tall grass, broadleaf plants, small insects, fruits, pods and large insects but not for those feeding exclusively on seeds. Dietary based data show that chronic RQ values exceed the Agency's chronic LOC for mammals feeding on short grass, tall grass, broadleaf plants and small insects but not for those feeding exclusively on fruits, pods and large insects.

4.1.1.4 Non-target Terrestrial and Semi-Aquatic Plants

Although there are no acceptable data to assess the possible risks of fluazifop-p-butyl to dicot species, risks are presumed to be minimal due to the fact that fluazifop-p-butyl has a mode of action specific to monocot terrestrial plants and is routinely applied to a variety of dicot plant crops at similar application rates and there are no reported incidents of damage to dicot plant species in the EIIS database. Similarly, there are no restrictions or advisories against the application of this chemical to dicot plants on the current label. However, risks are presumed for monocot terrestrial and semi-aquatic plants, and lichens due to the lack of toxicity data for these species.

4.2 Risk Description

The results of this risk assessment indicate that there are potential effects to listed estuarine/marine invertebrates, mammals, terrestrial monocot plants, aquatic plants algae and lichens from the proposed new applications of fluazifop-p-butyl.

4.2.1 Risks to Aquatic Organisms

The Agency's acute LOC was not exceeded for any non-listed aquatic animal species (LOC = 0.5). The Agency's endangered LOC value (0.05) was met or exceeded for acute risks to listed estuarine/marine invertebrates and freshwater mollusks for all proposed applications except both ground and aerial applications under the WA beans scenario. The Agency's acute endangered LOC value was not exceeded for freshwater or estuarine/marine fish or for freshwater crustaceans.

The Agency's chronic LOC was not exceeded for fish or invertebrates for any scenario. However, there is one incident of a fish kill resulting from a registered use fluazifop-p-butyl in combination with other compounds reported in EFED's Ecological Incident Information System (EIIS) database:

> Incident: I007601-001
> 1998 A fish kill occurred in a small pond in Phillipstown, IL, killing about 200 catfish, largemouth bass, crappie, and red ear sunfish. The kill happened following application with a tank mix of Fusion (fluazifop-p-butyl and fenoxaprop-p-ethyl) and Flexstar (Fomesafen Sodium) to nearby soybeans. The treated area was separated from the pond by a minimum of 100 feet with thick hedgerow and mature trees in between. The pond was 1/10 acre and about 10 feet deep. On the evening following the application there was a 0.9" rainfall. Winds were reported to be between 10 and 20 mph. There was no evidence of damage to plants around the pond. This suggests that there were not significant amounts of drift of the herbicides into the pond, but the pond could have been contaminated by runoff from the fields after the rainfall. Fomesafen sodium is not likely the cause of the fish mortality since it is practically nontoxic to fish. Fenoxaprop-p-ethyl could have contributed to the cause because it is highly toxic to fish.

Due to its toxicological specificity to monocot plant species, fluazifop-p-butyl is likely to pose risks to listed and non-listed non-target aquatic nonvascular and vascular plants. While there was one test with a freshwater algal species which did not indicate there would be concerns, because the full suite of algal species were not tested, the cyanobacterium was not tested, no vascular aquatic plants were tested and given that the test with *P. subcaptiatata* is only supplemental, and that fluazifop-p-butyl is a herbicide, insufficient information is available to definitively say there is no risk. Therefore, risks to aquatic vascular plants, algae and lichens are presumed in the absence of this data.

There are no data to evaluate the toxicity of degradate X for any plant or animal. In fate studies, degradate X made up to 37% of applied equivalents. If the toxicity of degradate X is presumed to be as toxic as the parent compound, increased risks to estuarine/marine invertebrates and freshwater mollusks are expected.

4.2.2 Risks to Terrestrial Organisms

4.2.2.1 Terrestrial Animals

No acute risks are expected for mammals and birds from the proposed new uses of fluazifop-p-butyl. Acute risk quotients did not exceed the Agency's LOC for terrestrial invertebrates, mammals or birds for any of the proposed uses of fluazifop-p-butyl. However, the dose based chronic mammalian RQ values exceed the Agency's LOC for all proposed uses except for mammals feeding only on seeds and the dietary based chronic mammalian RQ values exceed the Agency's LOC for all proposed uses except for mammals feeding only on fruits, pods, or large insects.

4.2.2.2 Terrestrial Plants

There are no acceptable data regarding the toxicity of fluazifop-p-butyl to terrestrial plants. However, fluazifop-p-butyl at the proposed application rates is likely to pose risks to non-target terrestrial monocot plants given that fluazifop-p-butyl is registered to control monocot plant species and that there are three reported incidents in EFED's EIIS database where crop damage was reported on corn, which is a monocot species:

Incident: I012499-038
2001 Syngenta reported a complaint that an application of FLEXSTAR herbicide on field corn damaged 90 of the 175 acres treated (51%). The symptoms were discoloration and bleaching. FUSION was also applied. The incident occurred in Ida Grove, IA.

Incident: I012499-024
2001 Syngenta reported a complaint that an application of FLEXSTAR herbicide on field corn damaged 75 of the 120 acres treated (65%). The symptom was chlorosis. Fusion herbicide was also applied. The incident occurred in Mechanicsville, IA.

I012499-031
2001 Syngenta reported a complaint from a farmer that use of FLEXSTAR herbicide damaged all 195 acres of field corn that was treated. The symptom was

necrosis (brown or dead leaves). Fusion herbicide was also applied. The incident occurred in Lidderdale, IA.

Incidents were also reported on soybeans and for the racemic mixture of fluazifop-butyl incidents were reported for peanut. These are dicot species. None of these uses were shown to be for a registered use.

I007755-022
In 1998, a complaint was made that use of FUSION herbicide resulted in plant damage to 20 acres of soybeans. The application rate was not reported and this may not have been a registered use. It is possible that this type of incident could occur again. The incident occurred in Clay County, IN.

I011838-012
In 2001, a complaint was made that an application of FUSILADE herbicide on peanut resulted in stand reduction in 70 of the 207 acres treated (34%). The use may not have been a registered use and it is possible that it could occur again. The incident occurred in Mitchell County, GA.

There are no acceptable data regarding the toxicity of fluazifop-p-butyl to terrestrial plants. However, fluazifop-p-butyl at the proposed application rates is likely to pose risks to non-target listed and non-listed monocot plants given that fluazifop-p-butyl is registered to control monocot plant species.

Although there are no acceptable data to assess the possible risks of fluazifop-p-butyl to dicot species, risks are presumed to be minimal due to the fact that fluazifop-p-butyl is routinely applied to a variety of dicot plant crops at similar application rates and there are no reported incidents of damage to dicot plant species in the EIIS database for registered uses. However, due to the lack of toxicity data, risks are presumed for and lichens (of which algae are a symbiont).

4.2.3 Federally Threatened and Endangered (Listed) Species Concerns

4.2.3.1 Taxonomic Groups potentially at Risk

The Agency's endangered LOC values were met or exceeded for acute risks to listed estuarine/marine invertebrates and freshwater mollusks for all proposed applications except both ground and aerial applications under the WA beans scenario. Risks are presumed for listed algae, lichens and aquatic and terrestrial monocot plants. A list of endangered/threatened species at the state level for these taxonomic groups is attached to this assessment. The registrant must provide information on the proximity of federally listed species to the fluazifop-p-butyl use sites. This requirement may be satisfied in one of three ways: 1) having membership in the FIFRA Endangered Species Task Force (Pesticide Registration [PR] Notice 2000-2); 2) citing FIFRA Endangered Species Task Force data; or 3) independently producing these data, provided the information is of sufficient quality to meet FIFRA requirements. The information will be used by the OPP Endangered Species Protection Program to develop recommendations to avoid adverse effects to listed species.

4.2.4 Implications of Sublethal Effects

4.2.4.1 Indirect Effects Analysis

The Agency acknowledges that pesticides have the potential to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering the extent of nesting habitat, creating gaps in the food chain, etc. In conducting a screen for indirect effects, direct effect LOCs for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-endangered organisms in these taxonomic groups as resources critical to their life cycle. Based on this analysis, aquatic animals are the most likely species to be affected by the proposed new uses.

4.2.4.2 Critical Habitat

In the evaluation of pesticide effects on designated critical habitat, consideration is given to the physical and biological features (constituent elements) of a critical habitat identified by the U.S Fish and Wildlife and National Marine Fisheries Services as essential to the conservation of a listed species and which may require special management considerations or protection. The evaluation of impacts for a screening level pesticide risk assessment focuses on the biological features that are constituent elements and is accomplished using the screening-level taxonomic analysis (risk quotients, RQ's) and listed species levels of concern (LOCs) that are used to evaluate direct and indirect effects to listed organisms.

The screening-level risk assessment has identified potential concerns for indirect effects on listed species for those organisms dependant upon terrestrial monocot plants and aquatic plants and animals. In light of the potential for indirect effects, the next step for EPA and the Service(s) is to identify which listed species and critical habitat are potentially implicated. Analytically, the identification of such species and critical habitat can occur in either of two ways. First, the agencies could determine whether the action area overlaps critical habitat or the occupied range of any listed species. If so, EPA would examine whether the pesticide's potential impacts on non-endangered species would affect the listed species indirectly or directly affect a constituent element of the critical habitat. Alternatively, the agencies could determine which listed species depend on biological resources, or have constituent elements that fall into, the taxa that may be directly or indirectly impacted by the pesticide. Then EPA would determine whether use of the pesticide overlaps the critical habitat or the occupied range of those listed species. At present, the information reviewed by EPA does not permit use of either analytical approach to make a definitive identification of species that are potentially impacted indirectly or critical habitats that is potentially impacted directly by the use of the pesticide. EPA and the Service(s) are working together to conduct the necessary analysis.

This screening-level risk assessment for critical habitat provides a listing of potential biological features that, if they are constituent elements of one or more critical habitats, would be of potential concern. These correspond to the taxa identified above as being of potential concern for indirect effects and include the following: aquatic organisms, birds, mammals, amphibians, reptiles, and insects. This list should serve as an initial step in problem formulation for further assessment of critical habitat impacts outlined above, should additional work be necessary.

4.2.4.3 Co-occurrence Analysis

The goal of the co-location evaluation is to determine whether potential use sites of fluazifop-p-butyl are geographically associated with known locations of listed species that might be exposed. At the screening level, this analysis is typically done using EFED's Location of Crops and Threatened and Endangered Species (LOCATES) database, which contains state and county-level data for listed species. See Appendix F for specific listings of listed species by State and County likely to be at risk from proposed fluazifop-p-butyl uses. Species unlikely to be exposed to fluazifop-p-butyl from this application were excluded from this list (*e.g.*, Florida panther); however this analysis does not take into account possible indirect effects such as loss of prey from these proposed uses.

4.3 Description of Assumptions, Limitations, Uncertainties and Data Gaps.

There are no chronic toxicity data available for the Agency to access chronic risk of fluazifop-butyl and fluazifop-acid to marine and estuarine fish, therefore ACR analysis was employed. There are also no acceptable studies addressing the toxicity of fluazifop-p-butyl to terrestrial or aquatic plants.

4.3.1 Related to Exposure for All Species

This screening-level risk assessment relies on labeled statements of the maximum rate of fluazifop-p-butyl application, the maximum number of applications, and the shortest interval between applications. Together, these assumptions constitute a maximum use scenario. The frequency at which actual uses approach these maximums is dependant on resistance to the insecticide, timing of applications, and market forces.

Degradate X, made up to 37% of applied equivalents in environmental fate studies; however, environmental fate data are not sufficient to estimate surface water EECs and toxicity data are not available to evaluate degradate X's toxicity. Although exposure to degradate X is expected to be lower than exposure to fluazifop-butyl or fluazifop-acid, not enough information is available to evaluate risk due to exposure to Degradate X.

4.3.2 Related to Exposure for Aquatic Species

4.3.2.1 Lack of Averaging Time for Exposure

For an acute risk assessment, there is no averaging time for exposure. An instantaneous peak concentration, with a 1 in 10 year return frequency, is assumed. The use of the instantaneous peak assumes that instantaneous exposure is of sufficient duration to elicit acute effects comparable to those observed over more protracted exposure periods tested in the laboratory, typically 48 to 96 hours. In the absence of data regarding time-to-toxic event analyses and latent responses to instantaneous exposure, the degree to which risk is overestimated cannot be quantified.

4.3.2.2 Model Input Values

Metabolism and physico-chemical properties of fluazifop-acid are used as inputs into PRZM/EXAMs, the modeling program that estimates surface water concentrations. Uncertainties associated with each of these individual components add to the overall uncertainty of the modeled concentrations. Metabolism input values are 1) calculated as the 90[th] percent confidence bound on the mean, 2) as the half-life multiplied by three when only one half-life is available or 3)are assumed to be stable when no data are available. The more data we have and the less variability there is in the data, the closer the value used in modeling comes to the actual mean. The fewer data points we have and/or the greater the variability in the study results, the higher the upper bound mean is skewed. No data were available on the photodegradation of fluazifop-acid and it was assumed to be stable in modeling. Laboratory studies indicated that fluazifop-acid was stable to hydrolysis in water and anaerobic aquatic metabolism. Upper confidence bounds of the means of aerobic soil metabolism and aerobic aquatic metabolism half-lives were also used. Such default inputs increase the uncertainty in aquatic exposure estimates, particularly chronic exposures and exposures in sediment. The default inputs generally skew toward being protective (*e.g.*, conservative or upper end for resulting EECs), but the actual range in the field may sometimes exceed EFED's estimates, though generally observed aquatic concentrations will be lower than the predicted EECs. Finally, the reliability of the water solubility is not known and the vapor pressure was estimated.

4.3.2.3 Fluazifop-butyl Degradation

The laboratory degradation data and field dissipation studies are somewhat contradictory. Laboratory studies, which provide input data for modeling, showed that fluazifop-butyl would only be present for hours to <2 days (Table 3-1). Chemicals with half-lives this short are typically not modeled because the chemical is not present long enough for transport to surface waters to occur. In this assessment, it was assumed that all of the applied chemical was fluazifop-acid and exposure would primarily be to fluazifop-acid. This is a conservative estimate of exposure because 1) under most conditions, the butyl will transform into the acid quickly and 2) fluazifop-butyl and fluazifop-acid are expected to have similar toxicities and so estimating exposure to the acid should also cover exposure to the butyl. However, terrestrial field dissipations studies do indicate that fluazifop-butyl may be present for days to weeks and monitoring studies found residues of fluazifop-butyl in surface water and ground water. This should not significantly influence the conclusions of this risk assessment unless the toxicity one compound is found to be substantially more toxic than the other. Given the similar structures and the metabolism of the butyl to the acid in organisms, this is unlikely.

4.3.2.4 General Uncertainties Related to Aquatic Exposure Modeled Using Standard EPA Procedures

Other uncertainties related to exposure for aquatic species are briefly introduced below. More complete discussions of these uncertainties are available in the Overview Document (EPA 2004a).

- **Standard Surface Water Body:** The standard ecological water body scenario (EXAMS pond) used to calculate potential aquatic exposure to pesticides is intended to represent conservative estimates, and to avoid underestimations of the actual exposure. The Agency acknowledges that there are some unique aquatic habitats that are not accurately captured by this modeling scenario and modeling results may, therefore, under- or over-estimate exposure, depending on a number of variables.

- **Frequency of Exposure During a Given Year – 1 in 10 Year Return Frequency**: In general, the linked PRZM/EXAMS model produces estimated aquatic concentrations that are expected to be exceeded once within a ten-year period.
- **Dissipation in the Modeled Water Body:** Mass transport losses of pesticide from the modeled water body, except for losses by volatilization, degradation and sediment partitioning, are not considered. Additionally, the current water body model does not account for any potential to concentrate pesticide through the evaporative loss of water.
- **A Well-Mixed Pond**: Because the EXAMS model assumes instantaneous equilibrium and mixing, it does not consider the potential for higher short-term concentrations in the areas of the pond initially receiving pesticide runoff (*e.g.*, the shallow, near-shore areas of the pond) and drift (*e.g.*, the near-surface layer of the pond).
- **Routes of Exposure:** Screening-level risk assessments of pesticide application for aquatic organisms consider exposure primarily through the gills and integument. The dietary ingestion route was not directly assessed.
- **100 Percent Pesticide Treatment of the Pond Watershed:** The Agency assumes that 100 percent of the watershed is treated with the pesticide, which would result in a maximum possible exposure. This assumption may be realistic for small water bodies with associated small watershed areas, but for large watersheds, it would result in an overestimation of exposure.

4.3.3 Related to Exposure for Terrestrial Species

Screening-level risk assessments for applications of pesticides consider dietary exposure alone. Other routes of exposure, not considered in this assessment, are discussed below:

Incidental soil ingestion exposure - This risk assessment does not consider incidental soil ingestion. Available data suggests that up to 15% of the diet can consist of incidentally ingested soil depending on the species and feeding strategy (Beyer *et al.* 1994).

Inhalation Exposure - The screening risk assessment does not consider inhalation exposure. Such exposure may occur through three potential sources: (1) spray material in droplet form at the time of application (2) vapor phase pesticide volatilizing from treated surfaces, and (3) airborne particulate (soil, vegetative material, and pesticide dusts). While the vapor pressure of fluazifop-butyl (0.12-0.23 mPa) and fluazifop-acid (estimated to be 0.037 mPa) indicate they are non-volatile, they could be considered semi-volatile. For example, pesticides with vapor pressures of 0.83 and 0.024 mPa have been found in remote environments (Daly *et al.* 2007; Gouin *et al.* 2004). Some transport through the air may occur for fluazifop-butyl and fluazifop-acid. Currently, tools are not available to evaluate long range transport or exposure to semi-volatile compounds.

Dermal Exposure - The screening assessment does not consider dermal exposure, except as it is indirectly included in calculations of RQ's based on lethal doses per unit of pesticide treated area. Dermal exposure may occur through three potential sources: (1) direct application of spray to terrestrial wildlife in the treated area or within the drift footprint, (2) incidental contact with contaminated vegetation, or (3) contact with contaminated water or soil.

Drinking Water Exposure - Drinking water exposure to a pesticide active ingredient may be the result of consumption of surface water or consumption of the pesticide in dew or other water on the surfaces of treated vegetation. Puddles on the treated field may also contain the chemical.

4.3.4 Related to Effects Assessment

4.3.4.1 Age class and sensitivity of effects thresholds

It is generally recognized that test organism age may have a significant impact on the observed sensitivity to a toxicant. The screening risk assessment acute toxicity data for fish are collected on juvenile fish between 0.1 and 5 grams. Aquatic invertebrate acute testing is performed on recommended immature age classes (*e.g.*, first instar for daphnids, second instar for amphipods, stoneflies and mayflies, and third instar for midges). Similarly, acute dietary testing with birds is also performed on juveniles, with mallard being 5-10 days old and quail 10-14 days old.

Testing of juveniles may overestimate toxicity at older age classes for active ingredients, such as fluazifop-p-butyl, that act directly (without metabolic transformation) because younger age classes may not have the enzymatic systems associated with detoxifying xenobiotics. The screening risk assessment has no current provisions for a generally applied method that accounts for this uncertainty. Insofar as the available toxicity data may provide ranges of sensitivity information with respect to age class, the risk assessment uses the most sensitive life-stage information as the conservative screening endpoint.

4.3.4.2 Use of the Most Sensitive Species Tested

Although the screening risk assessment relies on a selected toxicity endpoints from the most sensitive species tested, it does not necessarily mean that the selected toxicity endpoints reflect sensitivity of the most sensitive species existing in a given environment. The relative position of the most sensitive species tested in the distribution of all possible species is a function of the overall variability among species to a particular chemical. In the case of listed species, there is uncertainty regarding the relationship of the listed species' sensitivity and the most sensitive species tested.

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Appendix A: Summary of Fate Data for Fluazifop-butyl and Related Compounds

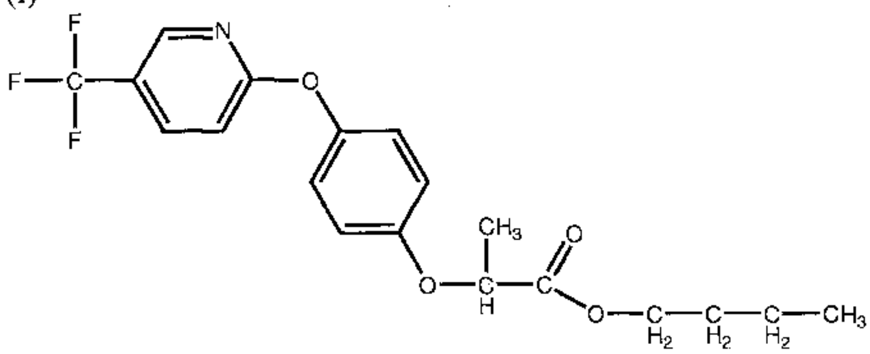
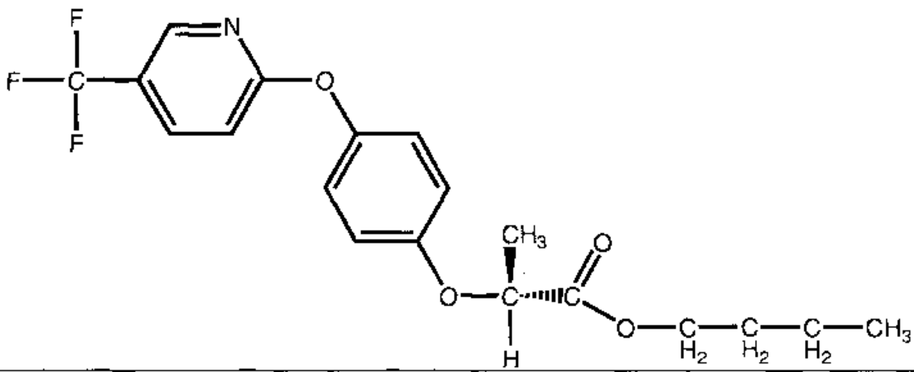
List of Tables in Appendix A.

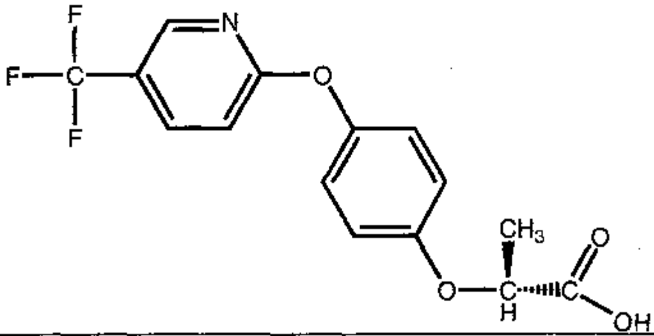
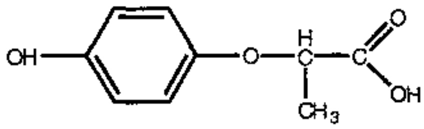
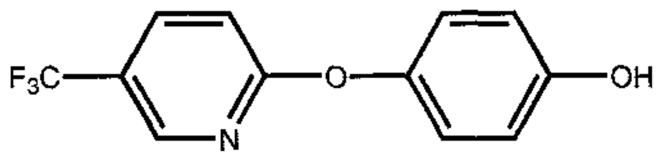
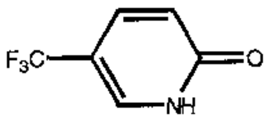
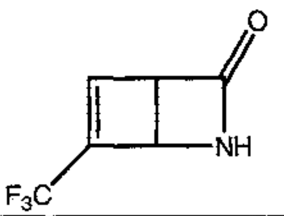
A1. Introduction

This document summarizes studies relevant to the environmental fate evaluation of fluazifop-butyl and related compounds. Many of the summaries were paraphrased or directly copied from the data evaluation records (DERs) summarizing the study. Open literature studies are summarized as the studies contribute to the understanding of the environmental fate of fluazifop-butyl; however, the information available in the study was only used in modeling if the information available on the study was considered sufficient to have a high confidence in the study results.

A2. Identity and Structure of Parent and Degradates

Table A 1. Names and Structures of Fluazifop Related Compounds[1]

Common Name:	Fluazifop-butyl
PC Code:	122805
IUPAC Name:	1-(2-Chlorobenzyl)-3-(1-methyl-1-phenylethyl)urea; 1-(2-Chlorobenzyl)-3-(α,α-dimethylbenzyl)urea
CAS Name:	N-[(2-Chlorophenyl)methyl]-N′-(1-methyl-1-phenylethyl)urea
CAS Number:	69806-50-4
Structure:	(I)[2] 
Common Name:	Fluazifop-p-butyl
PC Code:	122809
IUPAC Name:	butyl (*R*)-2-{4-[5-(trifluoromethyl)-2-pyridyloxy]phenoxy}propionate
CAS Name:	butyl (2*R*)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoate
Other Names	fluazifop-P butyl ester; fluazifop-r-butyl; Fusilade 2000; Fusilade DX; Fusilade S; Fusilade super; PP 005; Propanoic acid, 2-(4-((5-(trifluoromethyl)-2-pyridinyl)oxy)phenoxy)-, butyl ester, (R)-
CAS Number:	79241-46-6
Structure (I):	
Common Name:	Fluazifop-p and fluazifop-p-acid
IUPAC Name:	(R)-2-{4-[5-(Trifluoromethyl)-2-pyridyloxy]phenoxy}propionic acid; (R)-2-[4-(5-Trifluoromethyl-2-pyridyloxy)phenoxy]propionic acid

CAS Name: CAS No.	(2R)-2-[4-[[5-(Trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid 8306-88-0
Structure (degradate II, R enantiomer shown)	
Other Degradation Products:	• (degradate III); 2-(4-hydroxyphenoxy) propionic acid  • (degradate IV); 2-(4-hydroxyphenoxy)-5-trifluoromethylpyridine  • (degradate X); 2-Hydroxy-5-trifluoromethylpyridine; 5-trifluoromethyl-2-pyridone; CAS No. 33252-63-0  • cis-2-amino-3-trifluoromethylcyclobut-3-ene carboxylic acid lactam 

1 This table is based on information from chemfinder.com, MRID 46190601, Tu *et al.* 2001, and EXTOXNET (available at extoxnet.orst.edu).

2 The number in parenthesis corresponds to the structure in Figure 2-1

A3. Tables summarizing environmental fate data.

Table A 2. Summary of Degradation and Dissipation Studies for Fluazifop-p-butyl and Fluazifop-p-acid

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Study Parameters					Half-Life (days)	
			Media	°C	Duration (days)	Maximum Conc, Application Rate[3]	pH %OC % OM	Fluazifop-p-butyl	Fluazifop-p-acid
41598001 (1989)	Hydrolysis	Acceptable (10/26/1992)	Buffered water	25	30		5 7 9	Stable 78 0.4	--
46190601 (1995)	Hydrolysis	Acceptable (DER 4/29/2005)	Sterile buffered solution	25±1	31	5 mg/L	5 7 9	--	Stable Stable Stable
41598002 (1989)	Photolysis in Soil	Acceptable (10/26/1992)	Loam soil	25±5	~10 days continuous irradiation	420 g/hectare	6.5 4.3 % OM	195	--
162455 (1984)	Aerobic Soil	Not Classified	Sandy loam (British classification)	20	7	0.89 lb/A	6.8 5.3%OM	2 hours, half-life for the S form was also 2 hours	--
46190602 (1998)	Aerobic soil	Supplemental[5] (DER 4/29/2005)	Silt loam	20±2	59	1 mg/kg 1.13 kg/ha	7.0 1.9% OC	--	Linear = 10.5 Nonlinear DT50 = 8.3
			Sandy clay loam				5.8 2.1% OC		Linear = 9.8 Nonlinear DT50 = 8.2
			Sandy loam				7.2 2.2% OC		Linear = 7.5 Nonlinear DT50 = 2.7
			Sandy loam				5.3 0.9% OC		Linear = 13.9 Nonlinear DT50 = 9.1
			Sandy clay				7.1		Linear = 9.6

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Study Parameters					Half-Life (days)	
			Media	°C	Duration (days)	Maximum Conc, Application Rate[3]	pH %OC % OM	Fluazifop-p-butyl	Fluazifop-p-acid
			loam				3.1% OC		Nonlinear DT50 = 3.3
			Clay loam				7.7 4.3% OC		Linear = 9.1 Nonlinear DT50 = 2.3
Kah *et al.* (2007)	Aerobic Soil	Not used in modeling	Silty clay loam	15	Variable	2 mg/kg	8.20 1.77 %OC	--	6.0 ± 0.18[3]
			Sandy clay loam				7.81 3.24 %OC		6.1 ± 0.10
			Sandy clay loam				8.08 1.08 %OC		10.3 ± 0.37
			Sandy clay loam				7.91 2.0 %OC		6.3 ± 0.14
			Sandy clay loam				6.85 2.38 %OC		11.3 ± 0.40
			Sand				7.07 0.765 %OC		16.6 ± 0.76
			Loam				6.89 1.68 %OC		7 ± 0.49
			Clay				5.96 3.23 %OC		10.6 ± 0.80
			Sandy loam				5.28 1.5 %OC		13 ± 0.92
46190605 (1999)	Aerobic water-sediment	Acceptable (DER 04/26/2005)	Water/sand from England	20±2	100	0.12 mg/L 375 g/ha	7.75 water 91 mg/L OC 5.5 sediment 1.0% OC	--	Phenyl label 108 days (7-100-day data) Observed DT50 = 100

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Study Parameters					Half-Life (days)	
			Media	°C	Duration (days)	Maximum Conc, Application Rate[3]	pH %OC % OM	Fluazifop-p-butyl	Fluazifop-p-acid
			Water/sandy loam system from England				7.6 water 116.6 mg/l OC 8.1 sediment 6.6% OC		Pyridyl label Linear = 13.7 Observed DT50=30-59 Phenyl label Linear=23.2 Observed DT50=30-59 Pyridyl label Linear = 43.9 Observed DT50=30-59
El-Metwally *et al.* (2007)	Terrestrial Field Dissipation	Not used in modeling	Clay loam from Eqypt	NR	28	~30 – 50 ppm	7.79 1.78% OM	4 -6	--

1 Abbreviations: DER = data evaluation record; DT50 = dissipation time of 50% of the chemical

2 If the values were from the open literature it does not have a study status because a standard classification method is not. The results are reported because the information is still useful in describing the environmental fate of substances in the environment and an indication of whether the information is used in modeling is provided. Some studies completed prior 1985 have not been officially classified.

3 The values shown are the half-life ± the standard error.

4 The study was determined to be unacceptable because 1) no attempt was made to reconcile the results of this study with the results of the photolysis on soil study (MRID 41598002) and an earlier aqueous photolysis study (MRID 93788); 2) no time zero sample was taken; 3) no data was provided to show that pH was constant; and 4) it was not explicit that wavelengths below 290 nm were filtered.

5 The study was classified as supplemental because a material balance was not completed and transformation products were not addressed (DER 04/29/2005).

Table A 3. Summary of Degradation and Dissipation Studies for Fluazifop-butyl and Fluazifop-acid[1]

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Study Parameters					Half-Life (days)	
			Media	°C	Duration (days)	Maximum Conc, Application Rate[3]	pH %OC % OM	Fluazifop-butyl	Fluazifop-acid
87529 (1980)	Hydrolysis	Not classified	Buffered or distilled water	40	30	0.2 – 1.8	4 6 7 9	>120 35 17 0.2	--
Negre *et al.* (1988)	Hydrolysis	Not used in modeling	Filtered and deionized mili-Q water	25	~10	1.2 mg/L and 2.5 mg/L	4 7 9	Stable Stable 2.5	Fluazifop-acid showed minimal hydrolysis at pH 9
93788 (1981)	Photolysis in Water	Not classified	Sterile water	9-21	65 (14 - 16 days of light)	0.1 mg/L	6	Stable	--
93789 (1981)	Photolysis in Soil	Not classified	Loam soil	9-21	32 (7.5 days of light)	250 g/hectare	7.25 4.27% OM	Stable	--
Negre *et al.* (1988)	Sterile soil	Not used in modeling	Sandy loam	25	99	10 mg/kg	6.1 in water 1.72% OM	3 (pseudo first order)	--
87493 (1981) 92067032 (1990) 92067033 (1990)	Aerobic soil	Unacceptable for individual compounds (DER 10/26/1992) Supplemental for parent+acid[4,5] (DER 10/26/2003) Supplemental (DER 8/4/2008)	Sandy loam, 18 Acres Calcareous clay loam, Gore Hill Loamy sand, Frensham	25	315	1 mg/kg ~0.98 lb ai/A	6.0 4.6% OM 7.4 14.2% OM 5.4 2.1% OM	<2[3], all soils	Acid: 43-60 Parent + acid: 39-48[4] Parent+acid+unextracted: 178 -182 Acid: 42 Parent + acid: 37-40[4] Parent+acid+unextracted: 315-330 Acid: 34 Parent + Acid: 33[4] Parent+acid+unextracted: 112

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Study Parameters					Half-Life (days)	
			Media	°C	Duration (days)	Maximum Conc, Application Rate[3]	pH %OC % OM	Fluazifop-butyl	Fluazifop-acid
			Fen peat, Rosedean				6.7 67.4% OM		Acid: 54 Parent + Acid: 55[4] Parent+acid+unextracted: 385
			Coarse sand, Speyer 2.1				7.5 1.1% OM		21–84
			Coarse sand, Speyer 2.2				6.4 5.7%OM		> 168
			Loamy coarse sand, Speyer 2.3				7.7 1.1%OM		21–84
87492 (1980)	Aerobic Soil	Not Classified (DER 5/3/1984)[5]	Coarse sandy loam	25		1 kg/ha	6.8 3.1% OM	2 hours; unextractable phase not considered	--
			Coarse sand				6.4 1.4%OM	1; unextractable phase not considered	
Negre *et al.* (1988)	Aerobic soil	Not used in modeling	Sandy loam	25	21	10 mg/kg	6.1 in water 1.72% OM	<1	--
	Dry non-sterile soil	Not used in modeling	Sandy loam	25	21	10 mg/kg	6.1 in water 1.72% OM	17 (zero order)	--
Smith (1987)	Soil	Not used in modeling	Clay	20	2	5 µg/g	7.7, 4.2% OM	< 2 days in all soils when the moisture was	23
			Clay loam				6.0,		21

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Study Parameters					Half-Life (days)	
			Media	°C	Duration (days)	Maximum Conc, Application Rate[3]	pH %OC % OM	Fluazifop-butyl	Fluazifop-acid
			Sandy loam				11.7% OM 7.6, 4.0% OM	greater than 65% field capacity but >90% remained after 2 days in soils with < 20% moisture capacity	11
87493 (1981) 92067032 (1990) 92067033 (1990)	Anaerobic flooded soil	Unacceptable for individual compounds (DER 10/26/1992) Supplemental for parent+acid (DER 10/28/2003)[5] Supplemental (DER 8/4/2008)	Sandy loam, 18 Acres Calcareous clay loam, Gore Hill	25	315	1 mg/kg ~0.98 lb ai/A	6.0 4.6%OM 7.4 14.2%OM	< 2 - 2	Acid: 866 Parent + acid: 289-315[4] Parent+acid+unextracted: 330-408 Parent + acid: 990-1155[4] Parent+acid+unextracted: 1155-1733
41598003 (1989)	Terrestrial Field Dissipation	Unacceptable[9] (DER10/26/1992) Supplemental but does not fulfill guideline (DER Addendum 8/12/2008)	Sandy loam planted with cotton from CA	77-97°F (air)		0.75 lb ai/A, 2 app., 28 day interval	7.1-8.3 0.3-1.1 %OM	1.5	18
41598004 (1989)	Terrestrial Field	Supplemental but unacceptable	Sandy loam soil planted	63-98°F	1.25 months	0.29 mg/kg 0.75 lb ai/A, 2	6.6-8.5 0.1-2.2	13	42

MRID Number or Reference (Year)	Study Type	Status (Date of DER)[2] or Model Use	Study Parameters					Half-Life (days)	
			Media	°C	Duration (days)	Maximum Conc, Application Rate[3]	pH %OC % OM	Fluazifop-butyl	Fluazifop-acid
	Dissipation	for guideline (DER 11/9/1992)	with cotton from CA	soil		app., 28 day interval	%OM		
87495 (1981)	Terrestrial Field Dissipation	Unacceptable[7] (DER 10/26/1992)	Loamy fine sand from NC		91	0.34 ppm 2 lbs ai/A	5.6 0.8% OM	<14 17 (0-3 inches)	5
92067034 (1990)		Supplemental (DER Addendum 8/12/2008)	Silty clay loam from IL		270	ND 2 lbs ai/A	6.0 5.6 % OM	<7-21	83
			Fine sandy loam from CA		365	0.03 2 lbs ai/A	8.4 0.8% OM	<7	18
			Silty loam from MS		91	< 0.05 ppm 2 lbs ai/A	5.7 1.7% OM	<7	7
41900605 (1989)	Terrestrial Field Dissipation	Unacceptable[6] (DER 10/26/1992) Supplemental but does not fulfill guideline (DER Addendum 8/12/2008)	Loam soil planted with cotton in CA	38-97°F soil		0.75 lb ai/A 2 app., 28 day interval	7.2 1.2% OM	1.5	18
41900606 (1990)	Terrestrial Field Dissipation	Supplemental[8] (DER 11/9/1992)	Sandy loam soil planted with cotton			0.75 lb ai/A 2 app., 28 day interval	7.1 2.0% OM	13	42

1 Abbreviations: DER = data evaluation record; DT50 = dissipation time of 50% of the chemical; ND=not determined

2 If the values were from the open literature it does not have a study status because a standard classification method is not available. The results are reported because the information is useful in describing the environmental fate of substances in the environment and an indication of whether the information is used in modeling is provided. Some studies completed prior 1985 have not been officially classified.

3 An EFED Fate summary dated 2/17/1982 estimated a half-life less than 2 days because that was the earliest sampling point after application, the data evaluation record (DER) completed on 10/26/1992 indicated the results supported a half-life of less than a day.

4 The half-life was calculated using the linear/natural log equation.

5 Soils were classified using the British classification system.

6 These studies were previously classified as unacceptable because the plots were rototilled for weed control and, in some studies, residues could not be found or were found in much reduced levels after rototilling (DER 10/26/1992). The studies were upgraded to supplemental and the values may be considered a lower bound for rates of dissipation (DER Addendum No. 1 08/12/2008).

7 This study was previously classified as unacceptable because the sampling intervals were inadequate to accurately establish the half-life of the test substance, the application rate for parent fluazifop-butyl was not confirmed, and the analytical methods for determining the concentration of fluazifop-butyl and fluazifop-acid were not provided for review (DER 10/26/1992). The study was upgraded to supplemental and the values may be considered a lower bound for rates of dissipation (DER Addendum No. 1 08/12/2008).

8 The study was originally classified as unacceptable in part of the review and supplemental in another section because the dissipation of the degradate 5-trifluoromethyl-pyrid-2-one (degradate X) does not agree with the data reported in the aerobic metabolism and mobility laboratory studies (A. Abramovitch; EFED Fate Summary 11/9/1992; DP Barcode D157692, D157723, D165770). The study may be considered a lower bound for rates of dissipation.

Table A 4. Summary of Sorption Coefficients for Fluazifop-p-acid in Soil.[1]

MRID No or Reference Status/model use	Soil	%OC	pH	K_d (L/kg)	SD	Koc (L/kg)[2]	K_F (L/kg)	1/n	r^2	K_{FOC} (L/kg)[3]	Ceq Range (mg/L)
46190603 Supplemental	Silt loam	1.9	7.0	1.5	NR	80.3	0.8	0.68	0.9911	40.1	0.014 - 3.45
	Sandy clay loam	2.1	5.8	1.3		63.3	0.9	0.78	0.9996	42.2	0.019 – 3.51
	Sandy loam	2.2	7.2	4.4		200.4	38.5	0.50	0.9862	22.3	0.005 – 3.61
	Sandy loam	0.9	5.3	1.0		111.8	0.8	0.82	0.9992	83.6	0.022 – 3.77
	Sandy clay loam	3.1	7.1	4.3		139.3	1.2	0.56	0.9853	39.2	0.007 – 3.42
	Clay/loam loam	4.3	7.7	13.4		310.8	2.1	0.52	0.9606	48.7	0.003 – 2.81
Kah and Brown (2007) Not used in modeling	Silty clay loam	1.77	8.20	0.48	0.04	27.12	Only measured at one concentration				NR
	Silty clay loam	3.24	7.81	1.20	0.05	37.04					
	Sandy clay loam	1.08	8.08	0.28	0.02	25.93					
	Sandy clay loam	2.0	7.91	0.76	0.07	38.00					
	Sandy clay loam	2.38	6.85	0.64	0.01	26.89					
	Sandy	0.765	7.07	0.27	0.02	35.29					
	Loam	1.68	6.89	0.51	0.02	30.36					

MRID No or Reference Status/model use	Soil	%OC	pH	K_d (L/kg)	SD	Koc (L/kg)[2]	K_F (L/kg)	1/n	r^2	K_{FOC} (L/kg)[3]	Ceq Range (mg/L)
	Clay	3.23	5.96	1.57	0.04	48.61					
	Sandy Loam	1.5	5.28	0.89	0.12	59.33					

1 Abbreviations: NR=not reported. SD=standard deviation, Ceq range is the range of fluazifop-p concentrations in water at equilibrium
2 K_{OC} = regressed Kd *100/% OC or $K_{OC} = K_d$ x 1000/OC in g/kg.
3 $K_{FOC} = K_F$*100/%OC K_{FOC};

Table A 5. Summary of sorption coefficients for fluazifop-acid.

MRID No Status	Soil	%OC	pH	K_d (L/kg)	K_F (L/kg)	K_{OC}[1] (L/kg)	K_{FOC}[2] (L/kg)[5]	1/n
41900604 Acceptable	Sand, Lillyfield	0.77	5.3	0.24-0.38	0.23	53-84	51	Not reported
	Sandy loam, Frensham	3.1	6.1	0.14-0.29	0.14	13-26	13	
	Sandy loam, East Jubilee	1.9	6.0	0.18-0.40	0.17	10-22	9.5	
	Clay, Old Paddock	5.4	6.8	0.30-0.56	0.26	8.9-18	8.3	

1 K_{OC} = regressed Kd *100/% OC or $K_{OC} = K_d$ x 1000/OC in g/kg.
2 $K_{FOC} = K_F$*100/%OC K_{FOC}

Table A 6. Maximum Reported Amounts of Fluazifop-butyl and Degradation Products [1,2,3]

Chemical ID	Maximum % of Applied	Mean % of Applied at Study Termination	Study Type	MRID	Comments
Fluazifop-butyl	Not applicable	<0.1 (315d, sandy loam, phenyl) <0.1 (315 d, clay loam, phenyl) <0.1 (315 d, Fen peat, phenyl) <0.1 (168 d, loamy sand, phenyl) <0.1 (315 d, sandy loam, pyridyl) <0.1 (315 d, clay loam, pyridyl)	Aerobic soil[4]	87493, 92067032, 92067033	
	Not applicable	<0.1 (315 d, sandy loam, phenyl) <0.1 (315 d, clay loam, phenyl) <0.1 (315 d, sandy loam, pyridyl) <0.1 (315 d, clay loam, pyridyl)	Anaerobic flooded soil[4]	87493, 92067032, 92067033	
Fluazifop-p-butyl	Not applicable	97.9 (30 d, pH 5, phenyl) 96.9 (30 d, pH 5, pyridyl) 73.4 (30 d, pH 7, phenyl) 69.2 (30 d pH 7, pyridyl) 23.3 (3 d, pH 9, phenyl) 18.0 (3 d, pH 9, pyridyl)	Hydrolysis[4]	41598001	
	Not applicable	84.5 (10 d, phenyl) 74.7 (10 d, pyridyl	Photolysis in soil[4]	41598002	
	Not applicable	Not detected (7-100d, phenyll) Not detected (1-100 d, pyridyl)	Aerobic water/sediment	46190605	Virginia, water/sand
		ND (2-100d, phenyl label) ND (2-100d, pyridyl label)			Old Basing, England, water/sandy loam
Fluazifop-acid	**78.0** (2 d, sandy loam, phenyl) **83.4** (2, clay loam, phenyl) **83.7** (21 d, Fen peat, phenyl)	0.4 (315d, sandy loam, phenyl) 0.6 (315 d, clay loam, phenyl) 2.5 (315 d, Fen peat, phenyl)	Aerobic soil[4]	87493, 92067032, 92067033	

Chemical ID	Maximum % of Applied	Mean % of Applied at Study Termination	Study Type	MRID	Comments
	49.1 (21 d, loamy sand, phenyl) **41.5** (21 d, sandy loam, pyridyl) **42.6** (21 d, clay loam, pyridyl)	2.6 (168 d, loamy sand, phenyl) 0.9 (315 d, sandy loam, pyridyl) 0.2 (315 d, clay loam, pyridyl)			
	90.3 (2 d, system, phenyl) **49.4** (7 d, water, phenyl) **42.9** (84 d, soil, phenyl)	**42.8** (315 d, system, phenyl) **12.5** (315 d, system, phenyl) **30.3** (315 d, system, phenyl)	Anaerobic flooded soil[4]	87493, 92067032, 92067033	Sandy loam
	89.6 (2 d, system, phenyl) **55.4** (d, water, phenyl) **70.8** (315 d, soil, phenyl)	**78** (315 d, system, phenyl) 7.2 (315 d, water, phenyl) **70.8** (315 d, soil, phenyl)			Clay loam
	84.6 (21 d, system, pyridyl) **39.4** (21 d, water, pyridyl) **45.2** (21 d, soil, pyridyl)	**40.8** (315 d, system, pyridyl) **13.0** (315 d, water, pyridyl) **27.8** (315 d, soil, pyridyl)			Sandy loam
	89.5 (21 d, system, pyridyl) **34.5** (21d, water, pyridyl) **70.2** (315 d, soil, pyridyl)	**74.5** (315 d, system, pyridyl) 4.3 (315 d, water, pyridyl) **70.2** (315 d, soil, pyridyl)			Clay loam
Fluazifop-p-acid	NR (pH 5, phenyl) NR (pH 5, pyridyl) **22.4** (30.d, pH 7, phenyl) **24.1** (30 d, pH 7, pyridyl) **79.0** (30 d, pH 9, phenyl) **78.6** (30 d, pH 9, pyridyl)	NR (pH 5, phenyl) NR (pH 5, pyridyl) **22.4** (30 d, pH 7, phenyl) **24.1** (30 d pH 7, pyridyl) **79.0** (30 d, pH 9, phenyl) **18.0** (3 d, pH 9, pyridyl)	Hydrolysis[4]	41598001	
	8.5 (10 d, phenyl) 9.1 (10 d, pyridyl)	8.5 (10 d, phenyl) 9.1 (10 d, pyridyl)	Photolysis in soil[4]	41598002	
	Not applicable, fluazifop-p-acid parent in study	98.4 (31 d, pH 5, pyridyl) 101.6 (31 d, pH 5, phenyl) 97.3 (31 d, pH 7, pyridyl) 101.0 (31 d, pH 7, phenyl) 98.0 (31 d, pH 9, pyridyl)	Hydrolysis	46190601	

Chemical ID	Maximum % of Applied	Mean % of Applied at Study Termination	Study Type	MRID	Comments
		101.4 (31 d, pH 9, phenyl)			
	Not applicable, fluazifop-p-acid parent in study	2.1 (59 d, silt loam) 1.2 (59 d, sandy clay loam) 0.4 (59 d, sandy loam) 4.7 (59 d, sandy loam) 1.2 (59 d, sandy clay loam) 0.7 (59 d, clay loam)	Aerobic soil	46190602	
	96.7 (7 d, system, phenyl) **91.9** (7 d, water, phenyl) 9.8 (59 d, sediment, phenyl)	**50.9** (100 d, system, phenyl) **50.1** (100 d, water, phenyl) 0.8 (100, sediment, phenyl)	Aerobic water/ sediment	46190605	Virginia, water/sand
	97.3 (7 d, system, pyridyl) **96.9** (2 d, water, pyridyl) 5.5 (14, 30 d, sediment, pyridyl)	ND (100 d, system, pyridyl) ND (100 d, water, pyridyl) ND (100 d, sediment, pyridyl)			
	96.8 (1 d, system, phenyl) **91.2** (1 d, water, phenyl) **18.1** (59 d, sediment, phenyl)	3.8 (100 d, system, phenyl) ND (100 d, water, phenyl) 3.8 (100 d, sediment, phenyl)			Old Basing, England, water/sandy loam
	97.5 (2 d, system, pyridyl) **89.2** (0.167 d, water, pyridyl) **18.0** (30 d, sediment, pyridyl)	**22.3** (100 d, system, pyridyl) **14.1** (100 d, water, pyridyl) 8.2 (100 d, sediment, pyridyl)			
Degradate X	Not analyzed Not analyzed Not analyzed	Not analyzed Not analyzed Not analyzed	Hydrolysis Hydrolysis Hydrolysis	46190601 41598001 46190601	
	1.8 (10 d, pyridyl)	1.8 (10 d, pyridyl)	Photolysis in soil[4]	41598002	
	Not analyzed	Not analyzed	Aerobic soil	46190602	
	25.1 (84 d, sandy loam, pyridyl) **22.0** (84 d, clay loam, pyridyl)	9.8 (315 d, sandy loam, pyridyl) 7.9 (315 d, clay loam, pyridyl)	Aerobic soil[4]	87493, 92067032, 92067033	

Chemical ID	Maximum % of Applied	Mean % of Applied at Study Termination	Study Type	MRID	Comments
	37.4 (59 d, system, pyridyl) **33.3** (59 d, water, pyridyl) 4.0 (59 d, sediment, pyridyl) **24.4** (59 d, system, pyridyl) **16.3** (59 d, water, pyridyl) 8.1 (59 d, sediment, pyridyl)	**29.6** (100 d, system, pyridyl) **26.9** (100 d, water, pyridyl) 2.7 (100 d, sediment, pyridyl) **19.3** (100 d, system, pyridyl) **11.9** (100 d, water, pyridyl) 7.4 (100 d, sediment, pyridyl)	Aerobic water/sediment	46190605	Virginia, water/sand Old Basing, England, water/sandy loam
	6.5 (84 d, system, pyridyl) 2.2 (84 d, water, pyridyl) 4.5 (315 d, soil, pyridyl) 8.0 (84 d, system, clay loam, pyridyl) 1.1 (168d, water, clay loam, pyridyl) 7.8 (315 d, soil, clay loam, pyridyl)	6.3 (315 d, system, pyridyl) 1.8 (315 d, water, pyridyl) 4.5 (315 d, soil, pyridyl) 8.0 (315 d, system, pyridyl) 0.2 (315 d, water, pyridyl) 7.8 (315 d, soil, pyridyl)	Anaerobic flooded soil[4]	87493, 92067032, 92067033	Sandy loam Clay loam
Degradate III	Not analyzed Not analyzed Not analyzed Not analyzed Not analyzed Not analyzed Not analyzed	Not analyzed Not analyzed Not analyzed Not analyzed Not analyzed Not analyzed Not analyzed	Hydrolysis Hydrolysis Photolysis in soil Aerobic soil Aerobic soil Aerobic water/sediment Anaerobic flooded soil[4]	46190601 41598001 41598002 46190602 87493, 92067032, 92067033 46190605 87493, 92067032, 92067033	
Degradate IV	Not analyzed Not analyzed 0.6 (7 d, phenyl) 1.2 (7 d, pyridyl) Not analyzed 3.3 (21 d, sandy loam, phenyl)	Not analyzed Not analyzed ND (10 d, phenyl) ND (10 d, pyridyl) Not analyzed 0.6 (315 d, sandy loam, phenyl)	Hydrolysis Hydrolysis Photolysis in soil[4] Aerobic soil Aerobic soil[4]	46190601 41598001 41598002 46190602 87493,	

Chemical ID	Maximum % of Applied	Mean % of Applied at Study Termination	Study Type	MRID	Comments
	2.7 (21 d, clay loam, phenyl) 1.8 (168 d, Fen peat, phenyl) 2.2 (21 d, loamy sand, phenyl) 2.7 (84 d, sandy loam, pyridyl) 2.0 (21 d, clay loam, pyridyl)	1.0 (315 d, clay loam, phenyl) 0.9 (315 d, Fen peat, phenyl) 1.2 (168 d, loamy sand, phenyl) 1.2 (315 d, sandy loam, pyridyl) 0.8 (315 d, clay loam, pyridyl)		92067032, 92067033	
	3.7 (59 d, system, phenyl) NR (water, phenyl) 3.7 (59 d, sediment, phenyl)	1.6 (100 d, system, phenyl) NR (100 d, water, phenyl) 1.6 (100, sediment, phenyl)	Aerobic water/sediment	46190605	Virginia, water/sand
	9.9 (59 d, system, pyridyl) NR (water, pyridyl) 9.9 (59 d, sediment, pyridyl)	4.9 (100 d, system, pyridyl) NR (water, pyridyl) 4.9 (100 d, sediment, pyridyl)			
	9.5 (100 d, system, phenyl) NR (water, phenyl) 9.5 (100 d, sediment, phenyl)	9.5 (100 d, system, phenyl) NR (100 d, water, phenyl) 9.5 (100, sediment, phenyl)			Old Basing, England, water/sandy loam
	8.4 (59 d, system, pyridyl) NR (water, pyridyl) 8.4 (59 d, sediment, pyridyl)	6.8 (100 d, system, pyridyl) NR (water, pyridyl) 6.8 (100 d, sediment, pyridyl)			
	2.8 (168 d, system, phenyl) <0.1 (315 d, water, phenyl) 2.8 (168 d, soil, phenyl)	1.7 (315 d, system, phenyl) <0.1 (315 d, water, phenyl) 30.3 (1.7 d, soil, phenyl)	Anaerobic flooded soil[4]		Sandy loam
	3.7 (315 d, system, phenyl) 1.7 (0 d, water, phenyl) 3.7 (315 d, soil, phenyl)	3.7 (315 d, system, phenyl) <0.1 (315 d, water, phenyl) 3.7 (315 d, soil, phenyl)			Clay loam
	3.1 (315 d, system, pyridyl) <0.1 (315 d, water, pyridyl) 3.1 (315 d, soil, pyridyl)	3.1 (315 d, system, pyridyl) <0.1 (315 d, water, pyridyl) 3.1 (315 d, soil, pyridyl)			Sandy loam
	3.8 (315 d, system, pyridyl) 1.5 (0 d, water, pyridyl) 3.8 (315 d, soil, pyridyl)	3.8 (315 d, system, pyridyl) <0.1 (315 d, water, pyridyl) 3.8 (315 d, soil, pyridyl)			Clay loam

Chemical ID	Maximum % of Applied	Mean % of Applied at Study Termination	Study Type	MRID	Comments
Total Unknowns	1.3 (21d, pH 5, pyridyl) 1.2 (21 d, pH 5, phenyl) 1.4 (21d, pII 7, pyridyl) 0.9 (1, 10 d, pH 7, phenyl) 1.1 (31 d, pH 9, pyridyl) 1.2 (31 d, pH 9, phenyl)	0.5 (31d, pH 5, pyridyl) 0.4 (31 d, pH 5, phenyl) 0.8 (31d, pH 7, pyridyl) 0.8 (31 d, pH 7, phenyl) 1.1 (31 d, pH 9, pyridyl) 0.8 (31 d, pH 9, phenyl)	Hydrolysis	46190601	
	Not reported	Not reported	Hydrolysis	41598001	
	8.4 (10 d, phenyl) **12.9** (10 d, pyridyl)	8.4 (10 d, phenyl) **12.9** (10 d, pyridyl)	Photolysis in soil[4]	41598002	
	18.1 (30 d, silt loam) **23.4** (30 d, sandy clay loam) **20.7** (14 d, sandy loam) **22.0** (59 d, sandy loam) **15.7** (3 d, sandy clay loam) **18.6** (59 d, clay loam)	**17.6** (59 d, silt loam) **21.4** (59 d, sandy clay loam) **17.6** (59 d, sandy loam) **22.0** (59 d, sandy loam) **13.5** (59 d, sandy clay loam) **14.8** (59 d, clay loam)	Aerobic soil	46190602	
	70.8 (84 d, sandy loam, phenyl) **75.6** (84 d, clay loam, phenyl) **66.8** (84 d, Fen peat, phenyl) **64.2** (168 d, loamy sand, phenyl) **62.7** (315 d, sandy loam, pyridyl) **69.4** (21 d, clay loam, pyridyl)	**64.1** (315 d, sandy loam, phenyl) **62.6** (315 d, clay loam, phenyl) **62.4** (315 d, Fen peat, phenyl) **64.2** (168 d, loamy sand, phenyl) **62.7** (315 d, sandy loam, pyridyl) **64.9** (315 d, clay loam, pyridyl)	Aerobic soil[4]	87493, 92067032, 92067033	
	1.6 (100 d, system, phenyl) 6.4 (100 d system, pyridyl)	1.6 (100 d, system, phenyl) 6.4 (100 d system, pyridyl)	Aerobic water/sand sediment	46190605	Virginia, water/sand
	8.0 (100 d, system, phenyl) 6.1 (100 d, system, pyridyl)	8.0 (100 d, system, phenyl) 6.1 (100 d, system, pyridyl)			Old Basing, England, water/sandy loam
	37.8 (315 d, sandy loam, phenyl) **18.5** (168 d, clay loam, phenyl) **42.1** (315 d, sandy loam, pyridyl) **13.2** (168 d, clay loam, pyridyl)	**37.8** (315 d, sandy loam, phenyl) **13.7** (315 d, clay loam, phenyl) **42.1** (315 d, sandy loam, pyridyl) **10.8** (315 d, clay loam, pyridyl)	Anaerobic flooded soil	87493, 92067032, 92067033	

1 Abbreviations: ND= not detected; NR = not reported; phenyl and pyridyl indicate the radiolabeled ring

2 Major degradates and maximum amounts for degradates >10% are in bold. Unacceptable data were not reported. Refer to Table A 1 for chemical names and structures.

3 Unless specifically stated, when data are reported for fluazifop-p-butyl and fluazifop-p, those were the compounds applied and reported as recovered; however, the study did not report whether the method could distinguish between the R and S enantiomer. Specialized methods are needed to separate enantiomers and it is not known whether reported results are specific to the R enantiomer.

4 Reported as percent of recovered rather than percent applied.

Table A 7. Summary of results for the bioconcentration/bioaccumulation studies

MRID Number or Reference (Year)	Study Type Status	Exposure Concentration	Duration	Species	Bioconcentration Factor
93796 (1981) 92067035 (1990)	Bioaccumulation in laboratory fish Supplemental for fluazifop-acid and fluazifop-butyl but does not fulfill guideline (DER 10/26/1992)	6.8 µg/L fluazifop-butyl /fluazifop mixture due to hydrolysis	28 days	Bluegill Sunfish	410 whole fish 120 muscle (edible tissue) 4800 viscera (nonedible tissue)
93795 (1981)	Bioaccumulation in fish Not classified	Field treated at 0.5 kg ai/ha and flooded	65 days	Channell Catfish (*Ictalurus punctatus*)	Fluazifop 2.1 whole fish 1.1 muscle 8.0 viscera

Table A 8. Environmental Fate Classifications of Fluazifop-butyl and Fluazifop-acid

Factor	Classification	
	Fluazifop-butyl	**Fluazifiop-acid**
Volatility	Non-volatile[1]	Non-volatile[1]
Solubility	Slightly Soluble[2]	Readily Soluble[2]
Mobility	No Data	Very High to Medium[1] Mobile to Moderately Mobile[2]

1 Classification from "NAFTA Guidance Document for Conducting Terrestrial Field Dissipation Studies" available at http://www.epa.gov/oppefed1/ecorisk_ders/terrestrial_field_dissipation_guidance.pdf (accessed May 22, 2008).

2 Classification from, "Assessing soil contamination A reference manual" available at http://www.fao.org/DOCREP/003/X2570E/X2570E06.htm (accessed March 24, 2008).

A4. Open Literature

A4-1. Metwally, I. M. and S. E. M. Shalby. 2007. Bio-remediation of fluazifop-p-butyl herbicide contaminated soil with special reference to efficacy of some weed control treatments in Faba Bean Plants. *Journal of Agriculture and Biological Sciences* 3(3): 157-165.

Degradation of fluazifop-p-butyl was examined in soils that were undisturbed, cultivated, exposed to hoeing, and inoculated with *Rhizobium*. Fusalide Super E.C. 12.5% was applied as a foliar application on 3.5 x 3.0 m plots uncultivated or planted with faba beans four weeks from sowing using a sprayer equipped with one nozzle. Four replicates of each treatment were completed and a control plot was also completed. The soil was a clay loam with an organic matter content of 1.78%, pH 7.79, total N 0.079%, and available P of 14.2 ppm. Soil samples were collected at 1 hour after application and 1, 7, 14, 21, and 28 days following application at a 10 cm soil depth. Samples were stored at -20°C until analysis. Residues were extracted using a shaker table extraction (solvents were methanol followed by ethyl acetate) and high pressure liquid chromatography (HPLC), detector not specified. The author did not report on whether the method could distinguish between the R and S isomers and residue concentrations were recovery corrected (rate of recovery was 89.2%). Initial soil concentrations ranged from 30.45- 39.89 ppm and decreased to not detected - 6.17 ppm over 28 days. Addition of *Rhizobium* had little effect on degradation rates when the soil was uncultivated. However, cultivation with addition of *Rhizobium* did show slightly shorter degradation rates. The bare ground dissipation half-life was 6.26 days and the dissipation half-life with soil mixing and *Rhizobium* was 5.8 days. Loss of fluazifop-p-butyl was 10 – 20% less in uncultivated soils (28 day concentrations ranged from 3.63 – 6.17 ppm) versus cultivated soils (concentrations ranged from not-detected to 0.12 ppm). A mass balance was not completed. These study results were not used in modeling because a mass balance was not completed and information on the analytical method was insufficient.[1]

A4-2. Kah, M. S. Beulke, and C. D. Brown. 2007. Factors influencing degradation of pesticides in soil. *J. Agric. Food. Chem.*: 55, 4487-4492.

Degradation and sorption of fluazifop-p-acid was examined in nine arable soils from southern England. The soils were collected from the top 20 cm. Soils were preincubated for eight days prior to application of technical grade fluazifop-p-acid and fluoroxypyr in 5 mL of water for an initial concentration of approximately 2 mg/kg. Soils were mixed, adjusted by weight to -33kPa and then transferred to 500 mL glass flasks and incubated at 15°C in the dark. Moisture content was maintained by weight twice a week and the moisture content ranged from 9.7 – 35.5 g water/100 g dry soil which was the moisture content at -33kPa pressure. Bioactivity was monitored and soils were characterized. At each time point, a 20 g sample of soil was transferred to 125 mL amber glass jar and frozen. Residues were extracted using a shaker table extraction (acidified methanol) and residues quantified using HPLC with wavelength detection and gas chromatography with mass spectrum detection (GC-MS). Percent recovery ranged from 97-112%. Sorption coefficients were also measured at one concentration using standard batch equilibrium methods. First-order half-lives ranged from 6.0 to 16.6 days (Table A 2). The soil properties that correlated best with degradation rates were the percent clay, Mg, and K. The soil pH had a strong positive correlation with the degradation rate. This is possibly due to a trend of increased total microbial biomass at lower pH. A mass balance was not completed. The study did not report whether the chemical methods could distinguish between the R and S isomers; however, results reported as specific to the R isomer. These results may be used in modeling.

A4-3. Kah, M. and C. D. Brown. 2007. Prediction of the adsorption of ionizable pesticides in soils. *J. Agric. Food Chem.*: 55, 2312-2322.

Sorption coefficients of technical grade fluazifop-p-acid (90-93% purity) were measured at one concentration in nine soils from England with four replicates of each soil. Degradation of fluazifop-p-acid was also characterized in these soils in Kah *et al.* 2007. Soils were collected from the top 20 cm, sieved to 3 mm, and air dried. Soil suspensions in 0.01 M $CaCl_2$ were prepared in 50 mL polytetrafluoroethylene (PTFE) centrifuge tubes with a soil solution ratio of 1:2 (w:w). The suspensions were pre-equibrilated for 14 hours on a side to side shaker (300 oscillation/minute) and then spiked with 0.2 – 0.5 mL pesticide in 0.01 M $CaCl_2$. Fluoxypyr was also applied to the same systems. The tubes were then shaken in the dark for 72 hours

[1] More information on the analytical method is available in another reference.

(equilibration time was verified for two of the soils prior to the experiment). After shaking, the soils were centrifuged and the supernatant was removed and analyzed to determine the equilibrium concentration in water (C_e in mg/L). The total amount in the system was estimated by preparing tubes without soil in triplicate and assuming that the difference in the amounts measured in soil less systems and the amounts measured in the soil systems was the amount bound to soil. Residues were confirmed using high-pressure liquid chromatography (HPLC) with a multiwave detector. Percent recoveries ranged from 97 – 112%. The study did not report whether the method could distinguish between the different isomers; however, the results were reported for fluazifop-p-acid and it is assumed that the results are for the R isomer. Sorption coefficients (K_d values) ranged from 0.27 – 1.57 mL/g and sorption was stronger in soils with lower pH KCl values and with higher organic carbon (OC) contents (Table A 9). Sorption coefficients for fluazifop-p-acid correlated best with Log D (lipophilicity), OC, and Ca.

Table A 9. Summary of Sorption Coefficients for Fluazifop-p-acid reported by Kah and Brown 2007.

Soil	pH water	pH KCl	OC (g/kg)	K_d (mL/g)[1]	K_{OC} (mL/g)[2]	Comments
Silty clay loam	8.20	8.02	17.7	0.48 (0.04)	27.12	Only measured at one concentration; soils from England; no mass balance was completed.
Sandy clay loam	7.81	7.54	32.4	1.20 (0.05)	37.04	
Sandy clay loam	8.08	7.41	10.8	0.28 (0.02)	25.93	
Sandy clay loam	7.91	7.29	20	0.76 (0.07)	38.00	
Sandy clay loam	6.85	6.27	23.8	0.64 (0.01)	26.89	
Sandy	7.07	6.46	7.65	0.27 (0.02)	35.29	
Loam	6.89	6.38	16.8	0.51 (0.02)	30.36	
Clay	5.96	4.87	32.3	1.57 (0.04)	48.61	
Sandy Loam	5.28	4.40	15	0.89 (0.12)	59.33	

1 The standard deviation from four replicates is reported in parentheses.

2 The K_{OC} was calculated as $K_{OC} = K_d \times 1000/OC$ in g/kg.

A4-4. Negre, M., M. Gennari, A. Gignetti, and E. Zanini. 1988. Degradation of fluazifop-buty in soil and aqueous systems. *J. Agric. Food. Chem.*: 36, 1319-1322.

Degradation of fluazifop-butyl was studied in sterile buffered water, sterile soil, and in nonsterile soil with different moisture contents. The grade of fluazifop-butyl was not specified.

Hydrolysis was examined at pH 4, 7, and 9 at final concentrations of 1.2 or 2.5 mg/L in the dark and concentrations of the parent and fluazifop-acid were measured in water over time. Minimal hydrolysis occurred at pH 4 and 7 and the pseudo first-order half-life at pH 9 at both concentrations was approximately 2.5 days. Fluazifop-acid was the major degradation product and did not undergo hydrolysis.

Soil was collected from the top 25 cm, dried to 10% water content (w/w), sieved to < 2-mm, and stored at room temperature in black polyvinyl chloride (PVC) bags. Soil was incubated in a closed system and evolved CO_2 was captured using 0.5 M NaOH. The system was also connected to a fresh O_2 supply to prevent anaerobic conditions. Some soils were sterilized with ethylene oxide. A standard solution (1 mL, 1000 mg/L in acetone) of fluazifop-butyl was applied to 3 g or dry soil in a 10-mL glass vial and acetone was allowed to evaporate. The soil was then added to 97 g soil dry weight and stirred for five minutes. The final concentration was 10 mg/kg dry weight. Degradation was examined in sterilized soil, soil with moisture contents of 20, 35, and 50% of maximum moisture capacity, and in non-sterile soil. Triplicate samples were taken for analysis on 1, 3, 7, and 21 days after application of fluazifop-butyl. Residues of fluazifop-butyl and fluazifop-acid were measured using HPLC, detector not specified. Initial total recoveries (fluazifop-butyl+fluazifop-acid as a percent of applied) were near 100%. The fluazifop-butyl half-life in non-sterile was < 1 day and was 3 days in sterile soil. This indicates that soil may have catalyzed hydrolysis. In sterile soil, 84% of the chemical applied was still extracted as fluazifop-acid after 99 days; however, in the non-sterile soils, fluazifop-acid residues declined. Half-lives were longest in dry soil (zero-order 17 days) and similar in the soils with differing moisture contents. These results were for the racemic mixture of fluazifop-butyl and fluazifop-acid, individual enantiomers were not discussed.

A4-5. Negre, M., M. Gennari, V. Andreoni, R. Ambrosoli, L. Celi. 1993. Microbial metabolism of fluazifop-butyl. *J. Environ. Sci. Health B 28(5)*: 545-576.

Degradation of fluazifop-butyl was examined in a mixed microbial culture in the presence of second carbon source and when fluazifop-butyl was the sole carbon source. Microbial cultures were isolated from landfill leachate and activated sludges from a sewage treatment plant. Fluazifop-butyl was added (125 mg/L) to a mixture of 60-mL mineral medium, 10 mL of preculture solution, and 10 mL sterilized aqueous solution in Erlenmeyer flasks. Flasks were maintained in the dark at 30°C on a rotary shaker. Some flasks were supplemented with sodium acetate or sodium propionate at 0.1 and 0.3% wt/v. Duplicate 5-ml samples were taken at time zero and throughout the experiment. Blank controls were performed by adding fluazifop-acid to mineral medium without microorganisms.

Fluazifop-acid was extracted using acidifying the solution to pH 2 with 1N hydrochloric acid and extracting three times with dichloromethane (DCM). The extract was concentrations with a rotary evaporator and redissolved in 5-mL methanol. HPLC analysis was performed with a Varian 5020 liquid chromatograph equipped with a diode array detector Perkin Elmer LC 235 operating at 270 nm. Recovery was greater than 90%. Chiral HPLC was performed with a 25 cm x 4.6 mm Chiracel OD (Daicel Chemical Ind.) eluted with a mobile phase comprising n-hexane + 2-propanol (90/10 v/v) added with 1% formic acid (1 mL/minute). Circulare dichorism spectra were carried out with a Jasco J/600 CD spectrophotometer.

Metabolites were isolated using thin layer chromatography (TLC) and detected with a ultraviolet (UV) lamp. Dark areas were visualized with a UV lamp (254 nm), scraped from the plates, and extracted with methanol for successive identification using UV spectrophotometry and HPLC determination, gas chromatograph – mass spectrometry (GC-MS), GC-IR with photoacoustic detector, and nuclear magnetic resonance (NMR).

When fluazifop was the sole carbon source or with a second carbon source at 0.1%, most of the degradation took place during the first days of the experiment and then the rate of degradation slowed, *e.g.*, two rates of degradation were present. Approximately, 50% was degraded at eight days and concentrations dropped to 30-43 % after 75 days. Chiral analysis showed that almost all fluazifop remaining after eight days was in the R-form. Negre *et al.* (1993) indicated that their results did not show an enzyme mediated inversion of the S enantiomer to the R enantiomer but a selective degradation of the S enantiomer.

A4-6. Smith, A.E. 1987. Persistence studies with the herbicide fluazifop-butyl in Saskatchewan soils under laboratory and field conditions. *Bull. Environ. Contam. Toxicol. 39*:150-155.

Degradation of fluazifop-butyl and fluazifop-acid was examined in three soils from western Canada. Soil samples were collected from the top 5 cm in September 1984, sieved (2-mm) and stored at room temperature until March 1985 when the soils were used in studies. The moisture capacity was less than 10% field capacity when the soils were collected. Fluazifop-butyl and fluazifop-acid (>99% purity) were used in laboratory studies and Fusilade (250g ai/L) was used in field studies.

Degradation of fluazifop-butyl in soil was examined by taking 20 g soil and bringing them up to 20, 65, and 100% field moisture capacity in glass stopper flasks. Fluazifop-butyl was added at 5.0 μg/g based on soil wet weight. The soils were then stirred and subsequently stored in the dark at 20°C. Duplicates samples of all treatments were extracted with aqueous acidic acetonitrile and analyzed after 24 and 48 hours. The amount of fluazifop-butyl remaining was determined with high pressure liquid chromatography (HPLC). A zero time sample was not collected and mass balance information was not reported. In soils with greater than 65% moisture capacity, less than 8% of fluazifop-butyl remained. In dry soils (20% field moisture capacity), greater than 90% of fluazifop-butyl was present after 48 hours.

Aerobic degradation of fluazifop-acid was examined in duplicate 50 g samples of three soils moistened to 85% of their field moisture capacity (with distilled water) weighed into 175-mL polystyrene foam containers fitted with plastic lids and incubated in the dark at 20°C for seven days. Distilled water was added every two days to replace that lost to evaporation. After this pre-equilibration period eight cartons of each soil were treated with fluazifop-acid at 2 μg/g, based on soil moist weights and thoroughly mixed and incubated in the dark at 20°C. Duplicate samples were extracted after 1 hour, and after 14, 28, and 42 days, and analyzed by HPLC with ultraviolet (uv) detection with confirmation with retention time of a standard reference. Residues were extracted in this experiment with aqueous ammoniated acetonitrile. This extraction procedure completely hydrolyzes fluazifop-butyl to fluazifop-acid. Mass balance information was not reported and a zero time sample was not collected. Measured half-lives were 23 days in the clay (pH 7.7, 4.2%OM), 21 days in the clay loam (pH 6.0m 11.7% OM), and 11 days in a sandy loam (pH 7.6, 4.0%OM).

A5. Hydrolysis

A5-1. Evans and Cavell 1980, MRID 87491; Not classified – information from Environmental Fate Review Memo dated 02/17/1982

The hydrolysis ^{14}C-phenyl labeled fluazifop-butyl (radiochemical purity ~99%) was studied at an unspecified temperature in aqueous buffered solutions of pH 3 and pH 11 for 14 hours, whether the samples were stored in the dark was not specified. Buffered solutions with labeled fluazifop-butyl were placed in a flask and refluxed, *e.g.*, boiled, with methanol at pH 3 and diethyl ether washings at pH 11 for 14 hours. Washings were concentrations using a rotary evaporator. Residues were counted using liquid scintillation counting (LSC) and the identity of the products confirmed using thin layer chromatography (TLC) and co-chromatography with authentic compounds. The major hydrolysis product was fluazifop-acid. At pH 11, complete hydrolysis occurred and the acid accounted for 70% of the radioactive materials. At pH 3, 2-(4-hydroxyphenoxy) propionic acid and 2-(4-hydroxyphenoxy)-5-trifluoromehtyl pyridine were identified as potential minor degradates. These data were not used in modeling as the systems were boiled.

A5-2. Makin *et al.* 1980, MRID 87529; Not Classified – information from Environmental Fate Review Memo dated 02/17/1982

Hydrolysis of ^{14}C-phenyl labeled fluazifop-butyl (radiochemical purity >98%) was studied in darkness at 15 and 40°C in sterilized buffer solutions at pH 4, 7, and 9. Hydrolysis in distilled water (pH 6) was also examined. The initial concentrations were 0.02, 0.1, and 1 ppm. Duplicate samples for each pH, temperature, and concentration were incubated for 3, 8, 16, and 30 days. Residues were extracted from water with methanol and diethyl ether, concentrated, and examined using LSC and two dimensional TLC and co-chromatography. Mass balance results ranged from 57 to 106%, but overall were within an acceptable range. Hydrolysis rates were independent of concentration and the rate of hydrolysis was highest at higher pH. The first-order half-lives of fluazifop-butyl at 40°C were > 120 days at pH 4, 35 days at pH 6, 17 days at pH 7, and 0.2 days at pH 9. Raising the reaction temperature from 15°C to 40°C increased the rate of hydrolysis by an order of magnitude at pH 9. Half-lives were not reported for 15°C. The major degradation product was fluazifop-acid.

A5-3. McCarron and Heath 1989, MRID 41598001; Acceptable (DER 10/26/1992)

Phenyl and pyridyl ring- labeled ^{14}C-fluazifop-p-butyl did not hydrolyze in a sterile pH 5 aqueous buffer solution that was incubated at 25°C in the dark for 30 days. ^{14}C-fluazifop-p-butyl did hydrolyze with registrant-calculated half-lives of 78 days at pH 7 and 29 hours at pH 9. ^{14}C-fluazifop-p-butyl averaged 97.4% of the recovered in the pH 5 solution at 30 days, 71.3% in the pH 7 solution at 30 days, and 20.6% in the pH 9 solution at 69 hours. The only degradate in the pH 7 and 9 solutions, 2-[4-(5-(trifluoromethy1)-2-pyridinyl] oxy) phenoxy] propanoic acid (fluazifop-acid), comprised 22.1% of recovered radioactivity at day 30 for pH 7 and 70.5% at 69 hours for pH 9. During the study, the material balances were ≥90.1% of the applied.

A5-4. Goodyear 1995, MRID 46190601; Acceptable (DER 4/29/2005)

The hydrolysis of [pyridyl-2,6-^{14}C] and [phenyl-U-^{14}C]-labeled (R)-2-{4-[5-(trifluoromethyl)-2-pyridyloxy]phenoxy}propionic acid (fluazifop-p-acid), at 5 mg a.i./L, was studied in sterile pH 5.2 (citrate), pH 6.9 (TRIS-maleic), and pH 9 (borate) aqueous buffered solutions for 31 days in the dark at 25 ± 1°C. The study was reportedly performed in accordance with USEPA Pesticide Assessment Guidelines, Subdivision N §161-1, and in compliance with USEPA and OECD Good Laboratory Practices. The test system consisted of sterile glass vessels (not further described) containing treated buffer solution (100 mL) that were sealed, mixed by shaking, and placed into a dark incubator at 25 ± 1°C. Duplicate test vials of each treatment combination were removed from the incubator at 0, 1, 4, 10, 21 and 31 days post treatment. Aliquots of the test solution were analyzed for total radioactivity using LSC. The test solutions were extracted into methanol using solid phase extraction techniques, and aliquots of the eluates were analyzed by LSC, HPLC and TLC. [^{14}C]Residues were identified by comparison to an unlabeled reference standard of fluazifop-p-acid.

In the [pyridyl-^{14}C]fluazifop-p-acid experiment, the overall [^{14}C]residue recoveries were 105.8 ± 7.1% of the applied (range 100.0-121.9%) for the pH 5 buffer, 104.9 ± 5.6% of the applied (range 99.1-117.3%) for the pH 7 buffer, and 106.6 ± 5.8% of the applied (range 99.8-120.4%) for the pH 9 buffer. In the [phenyl-^{14}C]fluazifop-p-acid experiment, the overall [^{14}C]residue recoveries were 106.4 ± 6.4% of the applied (range 98.1-121.2%) for the pH 5 buffer, 106.5 ± 6.6% of the applied (range 101.1-122.8%) for the pH 7 buffer, and 106.1 ± 4.5% of the applied (range 102.0-115.6%) for the pH 9 buffer.

[^{14}C]Fluazifop-p-acid (both labels) were stable in the pH 5, 7, and 9 buffer solutions during the 31-day study, with concentrations averaging 96.9-101.2% of the applied at time 0 and 97.3-101.6% at 31 days post treatment. No major transformation products were isolated and no minor transformation products were identified at any pH. Two or three unidentified components, which each measured ≤0.9% of the applied in all of the test solutions, may have been contaminants of the test solutions since they were detected at time 0 and exhibited no obvious pattern of increase.

Since no degradation occurred, a half-life could not be calculated and a transformation pathway could not be developed. The study was classified as acceptable (DER 4/29/2005).

A6. Photolysis

A6-1. Water; MacNeil *et al.* 1981, MRID 93788; Not classified – Based on summary from EFED environmental fate review dated 03/24/1982.

The aqueous phototransformation of 14C-phenyl labeled and 14C-pyridyl labeled fluazifop-butyl (radiochemical purity >99%) was examined in sterile solutions at pH 6 under natural sunlight and temperature (9-21°C) for 65 days. The initial concentration was 0.1 ppm and average light duration was 5.6 hours/day. Samples were collected at 0, 1, 2, 4, 16, 31, and 64 days. Dark control samples of aqueous solutions of 14C-fluazifop-butyl were analyzed at 32 and 64 days. Characterization of compounds was made using one and two dimensional TLC and co-chromatography with authentic compounds an automatic TLC linear analyzer. Total recovery of radioactivity ranged from 90-95%. After 64 days, ^{14}C-fluazifop-butyl accounted for 75% of the initial radioactive material. Fluazifop-acid and 2-(4-hydroxyphenoxy)-5-trifluoromethyl pyridine each accounted for 2-4% of radioactivity. No single compound other than the parent, accounted for greater than 10% of radioactivity. In the dark control, fluazifop-butyl accounted for 85% of the radioactivity and a half-life was not calculated. The study author concluded that there was not a significant difference in loss of the parent for the samples exposed to natural sunlight and the dark controls.

A6-2. Soil; MacNeil *et al.* 1981, MRID 93789; Not classified - Based on summary from EFED environmental fate review dated 03/24/1982.

Photodegradation of fluazifop-butyl (^{14}C phenyl and ^{14}C-pyridyl labeled; radiochemical purity was >97%) was studied in loam soils (60% sand, 16% silt, 24% clay, 4.27% OM, CEC 19 meq/100g dry soil; pH 7.25) application rates equivalent to 250g/hectare. Soil plates were placed in sealed flasks and exposed to natural sunlight for 32 days. Temperatures ranged from 9-21°C. Average light duration was 5.7 hours per day. Duplicate samples were collected on 0, 1, 2, 4, 16, and 32 days. Soil samples were extracted with acetonitrile and then filtered. Radioactive contents of the filtrates were determined using LSC. Extracts were also analyzed by TLC using one and two dimensional chromatography and co-chromatography with authentic compounds. Radioactive recovery ranged from 88-100%. After 32 days, fluazifop-butyl accounted for 82 and 84% of the radioactive residue in the soil and 86 to 95% of the radioactivity applied was recovered. Six photoproducts were found at less than 5% of the radioactive residues on soil including fluazifop-acid (1%) and 5-trifluoromethyl-2-pyridone (2%). The estimated half-life was reported to be 70 days; however, the dark control for the ^{14}C-pyridyl labeled samples had 81% of radiochemical applied present as fluazifop-butyl and the samples exposed to sunlight had 80% of applied present as the parent. Therefore, these results were assumed to indicate that fluazifop-butyl is stable to photolysis in soil.

A6-3. Soil; French and Matharu 1989, MRID 41598002; Acceptable (DER 10/26/1992)

Phenyl and pyridyl ring-labeled ^{14}C-fluazifop-p-butyl (radiochemical purities 98.0%), at 420 g/hectare, degraded with a registrant calculated half-life of 115.5 days on loam soil that was irradiated with artificial light (xenon lamp) for the equivalent of 30 days (~10 days continuous irradiation) of sunlight at 25± 5°C. After the equivalent of 30 days of irradiation, the degradates identified were 2-[4-(5-trifluoromethyl-2-pyridyloxy)phenoxy] propionic acid (fluazifop, II) at 4.3 to 9.1% of the recovered; 2-(4-hydroxyphenoxy)-5-trifluoromethyl pyridine (IV) at 0.3 to 0.6%; and 5-trifluoromethyl-2-pyridone (X) at 1.4 to 1.8%.

Uncharacterized radioactivity reported as unknown(s), baseline material, unidentified water soluble material and remainder were each ≤4.7% of the recovered radioactivity. Unextracted radioactivity was a maximum of 6.4% of the recovered radioactivity; carbon dioxide was a maximum of 1.1%.

In the dark control, ^{14}C-fluazifop-p-butyl degraded with a registrant calculated half-life of 272 days. After the equivalent of 30 days irradiation, fluazifop (II) was 3.2 to 4.1% of the recovered radioactivity, 2-(4-hydroxyphenoxy)-5-trifluoromethyl pyridine (IV) was 0.2 to 0.3%, and 5-trifluoromethyl-2-pyridone (X) was <0.3%. Uncharacterized radioactivity reported as unknown(s), unidentified water soluble material and remainder were each ≤2.0% of the recovered radioactivity. Unextracted radioactivity was a maximum of 6.4% of the recovered radioactivity. The photodegradation rate was estimated to be 195 days after normalization to the results of the dark control.

A6-4. Water; Jessup *et al.* 1991, MRID 42543202; Unacceptable (DER 6/3/1993)

^{14}C-phenyl labeled fluazifop-R-butyl (purity 98.7%) and ^{14}C-pyridyl labeled fluazifop-R-butyl, (purity 98.4%), at 0.5 µg/ml, photo-degraded in aqueous buffer solution at pH 5 when irradiated continuously for 4.76 days with a xenon arc lamp (maximum light intensity 641 mW/hr) in the presence of 30µl of acetonitrile. Half-lives were calculated at 6.02 days of Florida summer sunlight. Two degradates were identified. 2-(4-hydroxyphenoxy)-5-trifluromethyl pyridine (IV) was detected at levels up to 3.5% of the applied radioactivity and cis-2-amino-3-trifluoromethylcyclobut-3-ene carboxylic acid lactam was detected at levels up to 10.8% of the applied. Four other degradates were not identified and made up maximums of 7.08, 5.41, 12.36, and 8.61% of the applied, respectively. The study was determined to be unacceptable because 1) no attempt was made to reconcile the results of this study with the results of the photolysis on soil study (MRID 41598002) and an earlier aqueous photolysis study (MRID 93788); 2) no time zero sample was taken; 3) no data was provided to show that pH was constant; and 4) it was not explicit that wavelengths below 290 nm were filtered.

A7. Aerobic and Anaerobic Metabolism

A7-1. Soil and Aquatic Soil; Arnold et al. 1980, MRID 87492; Not classified - information from Environmental Fate Review Memo dated 02/17/1982

The biotransformation of a mixture of ^{14}C-phenyl labeled fluazifop-butyl and unlabeled fluazifop-butyl (stated purity of 97%; 60:40 ratio) was studied in a sandy loam soil (18 acres, pH 6.8, organic matter (OM) 3.1%) and a sand soil (Lillyfield, pH 6.4, OM 1.4%) from England. Six hours after treatment and incubation under aerobic conditions some samples were flooded. These soils were incubated for 12 hours to simulate anaerobic conditions and then soils were analyzed at zero time, 3, 8, and 21 weeks. The application rate was 1 mg a.i./kg soil. Labeled CO_2 was collected in ethanolamine and residues in soil were extracted by refluxing in isopropanol:water (4:1). Unextracted residues were measured by combustion. Quantitation of residues was performed using LSC. Some samples were also subject to TLC for confirmation of the identity of residues. Mass balances ranged from 93 – 102% of applied. Fluazifop-acid reached maximums of 45 and 76% or recovered radioactivity in the aerobic and flooded sandy loam soil at the zero time analysis. In the sandy soil, fluazifop-acid reached a maximum of 71% of recovered radioactivity. Little or no parent pesticide was found in water of the flooded soil and a maximum of 37% recovered radioactivity was present in water as fluazifop-acid on week 8. A minor degradation product, 2-(4-hydroxyphenoxy)-5-trifluoromethylpyridine was present in the sandy soil and reached a maximum of 9% of recovered radioactivity after 21 weeks of incubation. Fluazifop-acid showed significant degradation (44.9 reduced to 6.8 % of recovered radioactivity between 0 and 3 weeks) in the aerobic sandy loam soil but not in the flooded sandy loam and sandy soils. First-order half-lives were estimated to be 2 hours in the sandy loam soil and 1 day in the sandy soil. As the half-life was 2 hours in the sandy soil under aerobic conditions, only small amounts of the parent were found in the flooded soil.

A7-2. Soil and aquatic soil; Harvey *et al.* 1981, MRID 87493; Supplemented by Leahey 1990, MRID 92067032; and Leahey 1990, MRID 92067033; Supplemented by Bewick 1982, MRID 162454; Supplemental (DER addendum 10/26/2003); Recalculated half-lives DER addendum 8/4/2008)

The biotransformation of ^{14}C-phenyl labeled and 14C-pyridyl labeled fluazifop-butyl (98.3% radiochemical purity) were studied in a seven European soils (4 soils from the U.K. and 3 soils from Germany) and were not classifiable with the United States Department of Agriculture (USDA) system. The pH and OM content of the soils shown in Table A 10. Soils were brought to 40% moisture holding capacity and radiolabeled fluazifop-butyl was applied at a rate of 1 ppm. Soils were incubated for up to 45 weeks in the dark with a stream of CO_2 free air at 20°C. Some soils were flooded for 12 hours before beginning the time zero analysis to simulate anaerobic conditions. The German soils were stored for 1-year prior to use. Duplicate soil analyses were completed at 0, 2 days, 1, 3, 12, 24, and 45 weeks. $^{14}CO_2$ was trapped in ethanolamine and analyzed using liquid scintillation counting (LSC). Soil extracts were analyzed using LSC and TLC. Radioactivity recovered ranged from 88-106 % of applied. In all non-sterile soils, greater than 97% of fluazifop-butyl was lost within 2 days. The major product was fluazifop-acid. Fluazifop-acid was also lost from soil with half-lives of <2 weeks in the Gore and 18 acres soil, 3- 12 weeks in all other soils except the Speyer 2.2 where the half-life was > 24 weeks.

Anaerobic degradation was slower than in the unflooded soils. The amount of fluazifop-acid in the flooded Gore soil was stable over the 45 week period; however, the amount of fluazifop-acid declined over the 45 week period in the 18 acres soil.

Incubation of fluazifop-butyl at lower temperatures, higher concentrations, or at higher applications rates decreased the rate of fluazifop-acid degradation but had little effect on fluazifop-butyl rates of degradation. Other degradates measured were of 2-(4-hydroxyphenoxy)-5-trifluoromethylpyridine (maximum amount of radioactivity recovered) and 5-trifluoromethyl pyrid-2-one (approximately 25% of recovered radioactivity after 12 weeks of incubation). The study was reviewed in 1992 (DER 10/26/1992) and classified as unacceptable because the sampling intervals were inadequate to characterize the degradation of the parent compound. Additionally, the soils were of European origin and were not classified according to the USDA classification system and the soils had uncharacteristically high organic matter contents. The studies were reclassified as supplemental in 2003 (DER 10/28/2003) and half-lives calculated using the exponential decay equation for the parent plus the acid. The half-life for the parent and acid ranged from 315-347 days in the 18 acres soil and 952-1152 days in the gore soil under anaerobic conditions. The half-life for the parent plus acid ranged from 11.2-17.6 days in the 18 acres soil, 16.2-18.4 in the gore hill soil, and 26.4 days in the frensham soil under aerobic conditions. In 2008, half-lives were recalculated using the linear/natural log equation (DER addendum 8/4/2008). Using the linear/natural log equation, half-lives for the parent and acid ranged from 33 to 55 days in aerobic soils and 289 to 1155 days in anaerobic soils.[1]

Bewick 1982 (MRID 162454) re-analyzed the samples of three representative soils from Harvey *et al.*'s (MRID 87493) work. The extracts had been treated with ^{14}C-phenyl lableled fluazifop-

[1] These calculations did not include residues in the unextractable phase.

butyl. Isolation and derivatization of radioactivie compounds from the soil extracted was completed by fortifying "18 acres" zero time extract with fluazifop-butyl and other extracts with fluazifop. The extracts were then analyzed by TLC. Radioactive areas were eluted with methanol and concentrated. Fluazifop-acid derivatization was completed with ethereal diazomethane. Solutions were mixed with hexane and analyzed by LSC. Enantiomer ratios were determined using HPLC analysis of hexane solutions. The results were analyzed to show that storage did not greatly change the extracts. Recovery of radioactive residues throughout isolation and derivatization ranged from 66-105%. At time zero, results indicated that the R:S ratio of radioactive residues were approximately 50:50. Ratios of fluazifop-butyl were only analyzed at time zero. After two days of application the R:S ratio of radioactive residues for fluazifop-acid were approximately 81:18 in both the "18 acres" and "Gore" soils. In the one and three week samples, fluazifop-acid R:S ratios of radioactive residues were approximately 93-95:5-7. In the Frensham soil, R:S fluazifop-acid ratios were 64:37 in the three week sample and 92:8 in the 12 week sample. Table A 11 shows the distribution of fluazifop-acid enantiomers in soil extracts over time.

Table A 10. Summary of pH and percent organic matter in soils used in MRID 87493.

Soil	pH	Percent Organic Matter (OM)	European Soil Classification
18 Acres	6.0	4.6	Sandy loam
Gore Hill	7.4	14.2	Calcareous clay loam
Frensham	5.4	2.1	Loamy sand
Rosedean	6.7	67.4	Fen peat
Speyer 2.1	7.5	1.1	Coarse sand
Speyer 2.2	6.4	5.7	Coarse sand
Speyer 2.3	7.7	1.1	Loamy coarse sand

Table A 11. Enantiomer ratios of fluazifop-butyl and fluazifop-acid

Soil Type	Sampling Interval	R:S ratio[1]
18 Acres, sandy loam	Zerotime	Fluazifiop-butyl 50.7:49.3
	2 days	81.8:18.2
	1 week	94.6:5.4
	3 weeks	95.3:4.7
Gore, clay loam	2 days	81.2:18.8
	1 week	94.0:6.0
	3 weeks	93.0:7.0
Frensham, loamy sand	3 weeks	63.5:36.5
	12 weeks	92.3:7.7

[1] Except for the zerotime analysis, ratios are reported for fluazifop-acid.

A7-3. Soil; Bewick 1983, MRID 162455; Not classified (DER 5/3/1984)

Soil (pH 6.8, 5.3% OM, british classification of sandy loam) was treated with uniformly ^{14}C-phenyl-labeled fluazifop-butyl with either the R or S enantiomer at 1 kg/ha (0.89 lb/A, or 1 ppm) contained an a soil incubation system. Incubation was at 20°C with sampling at 0, 2, 6, and 12 hours and 1, 2, and 7 days. Soil was maintained at 40% moisture capacity at zero suction. The R and S enantiomers were separated by HPLC. The recovery of radioactive residues from soil ranged between 94-103% of applied. Both R and S enantiomers were hydrolyzed to fluazifop-acid with a half-life of less than 2 hours. The S enantiomer gradually changed to the R form over the seven day period with 98% in the R form on day seven. Half-lives for fluazifop-acid were not calculated.

A7-4. Soil; Goodyear 1998, MRID 46190602; Supplemental (DER 4/29/2005)

The biotransformation of [pyridyl-U-^{14}C]-labeled (R)-2-{4-[5-(trifluoromethyl)-2-pyridyloxy]phenoxy} propionic acid (fluazifop-p; radiochemical purity >99%), at 1 mg a.i./kg (equivalent to 1.13 kg a.i./ha), was studied in six soils from the UK for 59 days under aerobic conditions in darkness at 20 ± 2°C and a water holding capacity at 0.1 bar. The six soils were:

a silt loam ("A", pH 7.0, organic carbon 1.9%),
a sandy clay loam ("B", pH 5.8, organic carbon 2.1%),
a sandy loam ("C", pH 7.2, organic carbon 2.2%),
a sandy loam ("D", pH 5.3, organic carbon 0.9%),
a sandy clay loam ("E", pH 7.1, organic carbon 3.1%), and
a clay loam ("F", pH 7.7, organic carbon 4.3%).

The experiment was conducted in accordance with EC Directive 95/36/EC and in compliance with OECD GLP Standards. The test system consisted of glass jars (500 mL) containing treated soil (50 g); the jars were capped with lids containing holes to allow free air exchange. Volatiles were not collected. Duplicate jars were collected after 0, 1, 3, 7, 14, 30 and 59 days of incubation. Soil samples were extracted twice with acetonitrile:water (1:1, v:v) by shaking. The extracts were analyzed for total radioactivity using LSC and for [^{14}C]fluazifop-p by HPLC. Other extractable [^{14}C]residues were not characterized and nonextractable [^{14}C]residues were not quantified. [^{14}C]Fluazifop-p-acid was identified by comparison to an unlabeled reference standard of fluazifop-p-acid that was co-chromatographed with the sample.

[^{14}C]Fluazifop-p-acid degraded rapidly in all soils, with an observed DT50 of <3 days in the two sandy loam ("C" and "E") soils and the clay loam ("F") soil; 3-7 days in the silt loam ("A") and sandy clay loam ("B") soils, and *ca.* 7 days in the sandy loam ("D") soil. Transformation products were not characterized in any soil. Also, nonextractable residues were not measured and volatile compounds were not trapped.

Based on first-order linear regression analysis (Excel 2000), fluazifop-p-acid dissipated with calculated half-lives of 7.5-13.9 days in the six soils. Based on nonlinear regression analysis (SigmaPlot 8.0), fluazifop-p-acid dissipated with DT50 values of 8.3 days in the silt loam A soil, 8.2 days in the sandy clay loam B soil, 2.7 days in the sandy loam C soil, 9.1 days in the sandy loam D soil, 3.3 days in the sandy clay loam E soil and 2.3 days in the clay loam F soil. The rate of degradation was in part related to soil biomass; degradation occurred most rapidly in the soils with the highest biomass at study initiation and most slowly in the sandy loam soil ("D"), which had a very low biomass 82.7μC/g soil at study termination relative to the other five soils.

A transformation pathway was not proposed by the study author and could not be developed since transformation products were not addressed.

Table A 12. Summary of Measured Half-lives of Fluazifop-p-acid in Aerobic Soils

Soil type	Linear half-life	Nonlinear DT50
Silt loam ("A").	10.5 days (r^2 = 0.9286)	8.3 days (r^2 = 0.9888)
Sandy clay loam ("B")	9.8 days (r^2 = 0.9897)	8.2 days (r^2 = 0.9959)
Sandy loam ("C")	7.5 days (r^2 = 0.8989)	2.7 days (r^2 = 0.9804)
Sandy loam ("D")	13.9 days (r^2 = 0.8989)	9.1 days (r^2 = 0.9939)
Sandy clay loam ("E")	9.6 days (r^2 = 0.8986)	3.3 days (r2 = 0.9684)
Clay loam ("F")	9.1 days (r^2 = 0.8823)	2.3 days (r^2 = 0.9619)

The study was classified as supplemental because a material balance was not completed and transformation products were not addressed (DER 04/29/2005).

A7-5. Water sediment; Purser 1999, MRID 46190605; Acceptable (DER 04/26/2005)

The biotransformation of [^{14}C-phenyl]- and [^{14}C-pyridyl]- labeled butyl (R)-2-[4-(5-trifluromethyl-2-pyridyloxy)phenoxy] propionate (fluazifop-p-butyl) was studied in a water/sand system ("Virginia Water"; water pH 7.75, organic carbon 91.0 mg/L; sediment pH 5.5, organic carbon 1.0%) and a water/sandy loam system ("Old Basing"; water pH 7.60, organic carbon 116.6 mg/L; sediment pH 8.1, organic carbon 6.6%) from England for 100 days under aerobic conditions in darkness at 20 ± 2°C. Based on the water volume, [^{14}C] fluazifop-p-butyl was applied at a rate of *ca.* 0.12 mg a.i./L (equivalent to *ca.* 375 g/ha). The test systems consisted of borosilicate glass cylinders (4.5 cm, volume not specified) containing water and sediment that were pre-incubated for 67 days, then treated with either the phenyl- or pyridyl-labeled test material and connected to a continuous flow-through volatile trapping system. Moistened air was drawn over the water surface and passed in through ethanediol, 2% paraffin in xylene, and 2M NaOH. Single samples of each treatment combination were collected after 1, 2, 4 and 6 hours and 1, 2, 7, 14, 30, 59 and 100 days; the study author assumed that fluazifop-p-butyl comprised 100% of the applied at time zero. Water layers were decanted and analyzed without modification. Sediment samples were extracted three times with methanol by shaking, and the 59- and 100-day samples were also Soxhlet-extracted for 16 hours with methanol. Incubation units were washed with methanol. The water layers, sediment extracts, extracted sediment, trapping solutions, and unit washes were analyzed for total radioactivity by LSC. The water and the sediment extracts were each concentrated and analyzed by HPLC. [^{14}C]Fluazifop-p-butyl and its transformation products were identified by comparison to the retention times of unlabeled reference standards of fluazifop-p-butyl, fluazifop-p, 2-(4-hydroxyphenoxy)propionic acid (degradate III), (trifluoromethyl-2-pyridyoxy)phenol (degradate IV), and 5-(trifluoromethyl)2-pyridinol (degradate X). Identifications were confirmed by TLC. The test conditions outlined in the study appear to have been maintained throughout the 4-month incubation. Overall recovery of radiolabeled material (combined labels) averaged 98.0 ± 2.5% (range 93.9-101.3%, n = 22) of the applied in the sand systems and 97.2 ± 3.1% (range 90.9-103.2%, n = 22) in the sandy loam systems, with no clear pattern of decline over time.

[^{14}C]Fluazifop-p-butyl rapidly degraded to [^{14}C]fluazifop-p-acid in all systems, with a DT50 of *ca.* 2 hours and a DT90 of <1 day; ≤3.1% of the applied remained undegraded at 2 days post treatment and no detections occurred at and after 7 days. [^{14}C]Fluazifop-p-butyl was associated almost entirely with the water layer at all sampling intervals. [^{14}C]Fluazifop-p-acid was the primary transformation product from both labels in both the sand and sandy loam systems, comprising >90% of the applied in all systems at 1 day post treatment and declining to 74.7-89.7% at 30 days.

[^{14}C]Fluazifop-p-acid was associated primarily with the water layer throughout the study, but some adsorption to the sediment did occur over time. The other identified transformation products were [^{14}C](trifluoromethyl-2-pyridyloxy)phenol (degradate IV) and (in the pyridyl treatment only) and [^{14}C]5-(trifluoromethyl)-2-pyridinol (degradate X). [^{14}C](Trifluoromethyl-2-pryidyloxy)phenol was detected at maximums of 9.5-9.9% of the applied in the pyridyl-sand and the pyridyl- and phenyl-sandy loam systems, and at 3.7% in the phenyl-sand system. Degradate IV was associated only with the sediment phase. [^{14}C]5-(trifluoromethyl)-2-pyridinol was a maximum 33.3% of the applied in the sand system and 16.3% in the sandy loam system at 59 days post treatment, declining to 26.9% and 11.9%, respectively, at 100 days. [^{14}C]5-(trifluoromethyl)-2-pyridinol was detected in both the water and sediment, but primarily in the water. No other transformation products were identified. Total unextractables were assumed not to be fluazifop-p-butyl or fluazifop-p-acid. Fluazifop-p-butyl rapidly degraded to fluazifop-p-acid, fluazifop-p-acid is highly soluble, and little (< 7%) radioactivity was present in the unextractable phase in the first day. Therefore, it is not expected that the unextractable phase contained significant amounts of fluazifop-p-butyl or fluazifop-p-acid. This study was evaluated as acceptable (DER 04/26/2005).

A8. Mobility

A8-1. Batch Equilibrium in Soil; Stevens *et al.* 1981, MRID 93794; Unacceptable (classified by this reviewer)

^{14}C-pyridal labeled fluazifop-butyl and ^{14}C phenyl labeled fluazifop-acid were introduced into autoclaved soil samples (loamy sand, 2%OM) at concentrations of 0.002, 0.02, 0.1, and 0.2 ppm. Samples were shaken in the dark at 4 ppm at 21°C for 2, 6, and 24 hours with a soil:water ratio of 1:25. At the end of each period, slurries were centrifuged for 15 minutes. One mL aliquots of the supernatents were then withdrawn for LSC. After centrifugation, soils were extracted with isopropanol:water. Aliquots of the extracts were analyzed with LSC. After extraction, the soils were then combusted and the $^{14}CO_2$ was trapped in 2-methoxymethyl-amine for LSC.

Desorption was also examined. 14C-pyridal labeled fluazifop-butyl and 14C-phenyl labeled fluazifop were introduced into autoclaved soil samples at concentrations of 0.002, 0.02, 0.1, and 0.2 ppm. Samples were shaken in the dark at 4 rpm at 21±2°C, ten mL aliquots were removed at 24, 32, 48, and 56 hours. Fresh sterile aqueous 0.01 M $CaCl_2$ solution was added each time, other than the 56 hours to restore the slurry to its initial volume and the slurries were returned to shaking. The remaining residues in water versus soil were examined after 56 hours.

Total recoveries of fluazitop-butyl for the adsorption study ranged from 85-108% (average 95%) of applied fluazirop-butyl, with 2 exceptions at 76 and 45%. The results indicated that equilibrium is approached after 24 hours. Total recoveries of fluazifop-butyl for the desorption studies ranged from 67 to 100% (average 80%), with two exceptions at 54 and 63%. Total recoveries of fluazifop-acid ranged from 87 to 105% (average 98%) of applied.

Fluazifop-butyl had a K_d of approximately 70 μg/mL. Fluazifop-acid had a K_d of <1 μg/mL. This study has not been officially classified but would be classified as unacceptable because the soil was autoclaved.

A8-2. Batch Equilbirum in Soil; Lane and Vaughn, MRID 41900604; Acceptable (DER 10/26/1992)

Sorption of two fluazifop-butyl degradates, fluazifop-acid (II) and 5-trifluromethyl-pyrid-2-one (degradate X) were analyzed in two soils from England. Fluazifop-acid (radiochemical purity >97%) was determined to be mobile in sand, two sandy loams, and clay soil:CaC1, slurries (10:20) containing 0.05, 0.1, 0.2, 0.5, and 1.0 ppm ^{14}C-fluazifop-acid that were equilibrated for 24 hours at 20 °C. Freundlich K_F values were 0.23 for the sand soil, 0.14 and 0.17 for the two sandy loam soils, and 0.26 for the clay soil; respective Freundlich K_{OC}, values were 51, 13, 9.5, and 8.3. $K_{desorption}$ values ranged from 0.25 to 0.60 for the sand soil, 0.26 to 0.74 for the two sandy loam soils, and 0.43 to 0.73 for the clay soil. The material balances reported for all fluazifop-acid concentrations on one of the sandy loam soils (Frensham), and for 0.2 ppm fluazifop-acid of the other soils were 105-122%. Adsorption appeared to be related to pH, with increasing adsorption at lower pH's.

Based on batch equilibrium studies, ^{14}C labeled degradate X (radiochemical purity >97%) did not adsorb to sand, two sandy loam, and clay soil:CaCli slurries (5:20) containing 0.02, 0.04, 0.09, 0.22, and 0.44 ug/mL ^{14}C labeled degradate X (radiochemical purity > 97%) that were equilibrated for 24 hours at 20°C. After 24 hours of shaking, 104.1-108.0% of the applied radioactivity was recovered in the aqueous phase from the sand soil, 99.0-102.7% from the two sandy loam soils, and 96.0-101.2% from the clay soil. Material balances for the sand soil were 103-110%. These studies were determined to be acceptable (DER 10/26/1992).

A8-3. Batch Equilibrium in Soil; Goodyear 1998, MRID 46190603; Supplemental (DER 4/29/2005)

The adsorption/desorption characteristics of (pyridyl-2,6-^{14}C)-labeled fluazifop-p ((R)-2-{4-[5-(trifluoromethyl)-2-pyridyloxy]phenoxy}propionic acid) were studied in six soils from England: a silt loam (pH 7.0, organic carbon 1.9%], a clay loam/loam (pH 7.7, organic carbon 4.3%], two sandy clay loam (pH 5.8, organic carbon 2.1% and pH 7.1, organic carbon 3.1%), and two sandy loam (pH 7.2, organic carbon 2.2% and pH 5.3, organic carbon 0.9%) soils, in a batch equilibrium experiment. The experiment was conducted in accordance with the EC Directive 95/36/EC, Active Substances, Section 7.1.2 and OECD Guideline for Testing of Chemicals No. 106, and in compliance with OECD and United Kingdom GLP Regulations. The adsorption phase of the study was carried out by equilibrating soil with (pyridyl-2,6-^{14}C)-labeled fluazifop-p-acid at nominal test concentrations of 0.08, 0.4, 2.0, and 10.0 mg ai/kg for all test soils. A preliminary study showed that equilibration was achieved in 24 hours and the soils were equilibrated in the dark for 24 hours at 20 ± 2°C. The equilibrating solution used was 0.01M $CaCl_2$ solution, with soil:solution ratios of 1:2 (w:v) for all test soils. The desorption phase was carried out by replacing the adsorption solution with an equivalent volume of pesticide-free 0.01M $CaCl_2$ solution and equilibrating in the dark for 24 hours at 20 ± 2°C. Two desorption steps were conducted for all test soils.

The supernatant solution after adsorption and two desorption steps was separated by centrifugation and aliquots were analyzed for total radioactivity using LSC. Following the second desorption step, single replicates for all test soils treated at 2.0 mg ai/kg soil and single replicates at each of the four test concentrations for the sandy loam (Soil C; 56% sand) were extracted three times by shaking with acetonitrile:water (1:1, v:v). Following each extraction, the samples were pooled and aliquots of the supernatants were analyzed for total radioactivity using LSC. The soils were air-dried and homogenized, and aliquots were analyzed for total radioactivity using LSC following combustion.

The test solutions were not analyzed for parent or transformation products at the beginning or end of the experiment. However, in a preliminary experiment in which the six test soils treated with [^{14}C]fluazifop-p-acid at 10 mg ai/kg were equilibrated for 72 hours under the same conditions as described for the definitive experiment, [^{14}C]fluazifop-p-acid comprised 95.1-97.5% of the recovered radioactivity in the adsorption supernatants.

The mass balance at the end of the adsorption phase was not reported for any of the test soils. Mass balances at the end of desorption (two steps) were 99.7%, 100.3%, 100.4%, 99.9%, and 100.5% of the applied for the silt loam (Soil A), sandy clay loam (Soil B), sandy loam (Soil D), sandy clay loam (Soil E), and clay loam/loam (Soil F) soils, respectively, treated at 2.0 mg a.i./kg. For the sandy loam soil (Soil C), mass balances at the end of desorption were 98.4%, 97.9%, 99.0%, and 102.1% of the applied at test concentrations of 0.08, 0.4, 2.0, and 10.0 mg a.i./kg, respectively.

Registrant-calculated adsorption K_d values were 1.5, 1.3, 4.4, 1.0, 4.3, and 13.4 for the silt loam (Soil A), sandy clay loam (Soil B), sandy loam (Soil C), sandy loam (Soil D), sandy clay loam (Soil E), and clay loam/loam (Soil F) soils, respectively; corresponding adsorption K_{oc} values were 80.3, 63.3, 200.4, 111.8, 139.3, and 310.8. Registrant-calculated Freundlich K_{ads} values were 0.8, 0.9, 0.8, 0.8, 1.2, and 2.1 for the silt loam (Soil A), sandy clay loam (Soil B), sandy loam (Soil C), sandy loam (Soil D), sandy clay loam (Soil E), and clay loam/loam (Soil F) soils, respectively; corresponding Freundlich adsorption K_{oc} values were 40.1, 42.2, 38.5, 83.6, 39.2, and 48.7. Registrant-calculated Freundlich adsorption K_{om} values were 23.1, 24.6, 22.3, 47.0, 22.9, and 28.3 for the silt loam (Soil A), sandy clay loam (Soil B), sandy loam (Soil C), sandy loam (Soil D), sandy clay loam (Soil E), and clay loam/loam (Soil F) soils, respectively.

The study is classified as supplemental because material balances for five of the six test soils were determined for only one test concentration and none of the test soils had an organic matter content ≤ 1 % (DER 04/29/2005). Positive correlations existed between the K_d and percent organic carbon (r^2= 0.8158) and K_d and percent clay (r^2 = 0.3119). K_d values were lower at pH values between 5 and 7 and then were less variable at pHs between 7 and 8. The study author noted that adsorption of [^{14}C]fluazifop-p-acid to the test soils is partially irreversible, based on higher desorption constants compared to corresponding adsorption constants.

A8-4. Batch Equilibrium in Soil; Ziegler 1988, MRID 46190604; Unacceptable (DER 4/29/2005)

The adsorption/desorption characteristics of [^{14}C-carbonyl]-labeled fluazifop-p-butyl (butyl(R)-2-4-(5-trifluromethyl-2-pyridyloxy)phenoxy] propionate) were studied in four U.S. soils: a loamy sand soil (pH 6.0, organic carbon 0.51%) from North Carolina, a loam soil (pH 7.9, organic carbon 0.53%) from California, a silty clay loam soil (pH 7.1, organic carbon 1.69%) from Illinois, and a silt loam soil [pH 6.6, organic carbon 0.65%] from Mississippi in a batch equilibrium experiment. The test soils were heat-sterilized (121°C) prior to use in the study. The adsorption phase of the study was carried out by equilibrating heat-sterilized soil with [^{14}C-carbonyl]-labeled fluazifop-p-butyl at measured test concentrations of 0.105, 0.26, 0.55, 2.75, and 6.1 mg a.i./kg soil for all test soils. The soils were equilibrated for 24 hours at 24 ± 2°C (lighting conditions not reported). The equilibrating solution used was 0.01M $CaCl_2$ containing 1% sodium azide with soil:solution ratios of 1:5 (w:v) for all test soils. The desorption phase of the study was carried out by replacing the adsorption solution with an equivalent volume of pesticide-free 0.01M $CaCl_2$ solution and equilibrating for 24 hours at 24 ± 2°C (lighting conditions not reported). A single desorption step was conducted for all test soils.

The supernatant solution after adsorption and desorption was separated by centrifugation and aliquots were analyzed for total radioactivity using LSC. The soils were dried for 1 day under vacuum at room temperature, powdered, mixed, and weighed. Duplicate aliquots were analyzed for total radioactivity using LSC following combustion. Following the adsorption phase, the high-dose soils (6.1 mg ai/kg soil) were combined, evaporated to dryness at room temperature under a stream of nitrogen, dissolved in acetone, and analyzed for [^{14}C-carbonyl]fluazifop-p-butyl using one-dimensional TLC.

[^{14}C]Fluazifop-p-butyl comprised 97.3-98.9% of the total radioactivity in the high-dose sample extracts, indicating that the test substance was stable in the test samples. Mass balances at the end of the adsorption phase were not reported for any of the test soils. Mass balances at the end of the desorption phase were 81.60-109.41%, 85.73-103.13%, 77.94-93.73%, and 81.34-97.93% of the applied for the North Carolina loamy sand, California loam, Illinois silty clay loam, and Mississippi silt loam soils, respectively. Freundlich adsorption values were calculated using log x/m = log Kd + (1/n) log Ce. Results are summarized in the following Table A 13. The study was classified as unacceptable because the soils were heat sterilized prior to use and overall material balances were incomplete (<90% of the applied) for two of the four test soils.

Table A 13. Summary of sorption coefficients measured for fluazifop-butyl.

Soil	%OM	pH	K_F (L/kg)	K_{FOC} (L/kg)	1/n
Sandy loam (NC)	0.87	6.0	11.4	2240	1.03
Loam (CA)	0.90	7.9	8.2	1548	0.99
Silty clay loam (IL)	2.87	7.0	20.1	1190	0.99
Silt loam (MS)	1.10	6.6	13.9	32.2	0.99

A9. Field Dissipation

A9-1. Terrestrial; Ussary et al. 1981., MRID 87495; Iwata 1990, MRID 92067034; Unacceptable 10/26/1992; Supplemental (DER Addendum No. 1 8/12/2008)

Terrestrial field dissipation of fluazifop-butyl was studied in Goldsboro, NC; Champaign, IL; Visalia, CA, and Vicksburg MS. Single applications of 2 lbs active ingredient (ai) per acre (A) were made to fallow plots in between July and August of 1979. See Table A 14 for a description of the soil properties. Composite samples of 3-5 pounds of soil were collected at depths of 0- 3, 3-6, and 6-12 before application, immediately following application, 7 and 14 days, 1, 3, 6, and 9 months after application. Analysis of soils were completed using an ICI Americas Inc. method GRAM-15, HPLC method for determination of Fluazifop-butyl in soil and GRAM-16, HPLC Method for the determination of fluazifop-acid in soil, descriptions and references of these methods were not provided. Values were recovery corrected.

Fluazifop-butyl degraded with an observed half-life of approximately 14 days from a sandy loam soil (North Carolina) after a single treatment with fluazifop-butyl (Fusilade 2000, 1 lb/gallon EC, ICI Americas) at 2 lbs ai/A during July 1979. Fluazifop-butyl ("ester") was not detected in the sandy loam (California), silty clay loam (Illinois), and silty loam (Mississippi) soils of the other test sites treated with the same formulation and application rate during July and August 1979. Fluazifop-acid dissipated with a registrant-calculated half-life of 7-14 days in the soil at these sites. Fluazifop-butyl and fluazifop-acid were detected in the 6- to 12-inch soil depth (maximum sampling depth) at all test sites. Half-lives were recalculated assuming first order kinetics and the data available, results are shown in Table A 14.

At the North Carolina site, in the 0- 3 inch soil depth, fluazifop-butyl was 0.34 ppm immediately post treatment, 0.31 ppm at 7 days, and 0.19 ppm at 14 days. In the 3-6 and 6-12 inch soil depths, fluazifop-butyl was a maximum of 0.29 ppm (at 7 days) and 0.04 ppm (immediately post treatment), respectively. In the 0-3 inch soil depth, fluazifop-acid was 3.10 ppm immediately post treatment, 4.33 ppm at 7 days, 1.11 ppm at 14 days, 0.09 ppm at 30 days, and not detected at 91 days post treatment. In the 3-6 and 6-12 inch soil depths, fluazifop-acid was a maximum of 0.52 ppm (at 14 days) and 0.69 ppm (immediately post treatment), respectively.

At the Illinois site, fluazifop-butyl was detected in "trace" amounts at all soil depths (0-2-inches) only at 7 days post treatment; additionally, fluazifop-butyl was detected in "trace" amounts in the 6-12 inch soil depth immediately post treatment. In the 0-3 inch soil depth, fluazifop was 1.29 ppm immediately post treatment, 2.19 ppm at 7 days, 0.43 ppm at 30 days and 0.07-0.15 ppm at 90-270 days. In the 3-6 and 6-12 inch soil depths, fluazifop-acid was a maximum of 2.15 ppm and 0.06 ppm (both at 7 days), respectively.

At the Mississippi site, fluazifop-butyl was detected in "trace" amounts in the 0-3 inch soil depth immediately post treatment and in the 0-3 and 6-12-inch soil at 7 days post treatment. In the 0-3 inch soil depth, fluazifop-acid was 1.29 ppm immediately post treatment, 0.21 ppm at 7 days, 0.27 ppm at 15 days, and below the limits of detection (0.02-0.04 ppm) at 30 days. In the 3-6 and 6-12 inch soil depths, fluazifop was a maximum of 0.80 ppm and 0.14 ppm (both immediately post treatment), respectively.

At the California site, fluazifop-butyl was 0.03 ppm in the 0-3 inch soil depth immediately post treatment; fluazifop-butyl was not detected in other soil depths or at other sampling intervals. In the 0-3 inch soil depth, fluazifop was 1.67 ppm immediately post treatment, 0.53 ppm at 7 days, 0.28 ppm at 14 days, 0.03 ppm at 90 days, and below the limits of detection (0.02-0.04 ppm) at 180 days post treatment. In the 3-6 inch soil depth, fluazifop-acid was a maximum of 0.35 ppm at 14 days; fluazifop-acid was not detected in the 6-12 inch soil depth.

Table A 14. Summary of soil properties and dissipation half-lives for MRID 87495.

Location	Soil Type	pH	%OM	Half-life (days)	
				Fluazifop-butyl	Fluazifop
Goldsboro, NC	Loamy fine sand	5.6	0.8	<14 17a (0-3 inch)	5a fluazifop (0-3 inch)
Champaign, IL	Silty clay loam	6.0	5.2	21 < 7a fluazifop-butyl; all values non detectable	83a fluazifop (0-3 inches)
Visalia, CA	Fine sandy loam	8.4	0.8	<7 < 7a fluazifop-butyl; all values non detectable	18a fluazifop (0-3 inch)
Vicksburg, MS	Silty loam	5.7	1.9	<7 < 7a fluazifop-butyl; all values non detectable	7a fluazifop (0-3 inch)

a Recalculated value, see DER Addencudm No. 1 8/12/2008)

These studies were unacceptable because the sampling intervals were inadequate to accurately establish the half-life of the test substance, the application rate for parent fluazifop-butyl was not confirmed, and the analytical methods for determining the concentration of fluazifop-butyl and fluazifop-acid were not provided for review (DER 10/26/1992). The study was upgraded to supplemental and the values may be considered a lower bound for rates of dissipation (DER Addendum 1 08/12/2008). This study provides useful information on the presence of fluazifop-butyl and data was available to calculate dissipation half-lives of fluazifop-butyl in one study and fluazifop-acid at all sites studied. However, the study cannot be used to satisfy the guideline requirements.

A9-2. Terrestrial; Wiebe 1989, MRID 41598003; Unacceptable (DER 10/26/1992); Supplemental (DER Addendum No. 1 8/12/2008)

Fluazifop-butyl dissipated with a registrant-calculated half-life of 1.5 days from plots of sandy loam soil planted to cotton near Visalia, California, that were treated with two applications of fluazifop-butyl (Fusilade 2000, 1 lb/gallon EC, ICI Americas) at 0.75 lb ai/A (1.5 lb ai total). The fluazifop-butyl concentration in the 0-6 inch soil depth was 0.05-0.08 ppm immediately after the first treatment, and was not detected (<0.01 ppm at 7-90 days post treatment (after rototilling). Fluazifop-butyl was not detected below the 6-inch soil depth. The degradate fluazifop-acid, dissipated with a registrant-calculated half-life of 18 days. Fluazifop-acid residues in the 0-6 inch soil depth were 0.05-0.17 ppm immediately after the first treatment, 0.08-0.21 ppm immediately after the second treatment, 0.02-0.12 ppm at 14 days, 0.01-0.11 ppm at 28 days and ≤0.04 ppm at 60-90 days post treatment. Fluazifop-acid was not detected below the 6-inch soil depth.

During the study period, the air temperatures ranged from 44-104°F. The soil temperatures (8-inch depth) ranged from 71-97° F. Combined rainfall and irrigation was approximately 31 inches. The field was leveled before planting and the depth to the water table was 10-25 feet, averaging 15 feet.

These studies were classified as unacceptable because the field maintenance practices were inappropriate. The plots were rototilled for weed control which may have affected the dissipation of fluazifop-butyl. After rototilling, residues could not be found or were found in much reduced levels. This study was upgraded to supplemental because the data is scientifically valid and it provides information on the behavior of fluazifop-butyl in fields that are rototilled (DER Addendcum 1 8/12/2008). However, the study cannot be used to satisfy the guideline requirements and does not provide information on the leaching behavior of fluazifop-butyl and its degradates.

A9-3. Terrestrial; Wiebe 1989, MRID 41598004; Supplemental but unacceptable to satisfy Guideline (EFED Fate Summary 11/9/1992); Supplemental (DER Addendum No. 1 8/12/2008)

Fluazifop-butyl dissipated with a registrant-calculated half-life of 13 days from plots of sandy loam soil planted to cotton near Porterville, California, that were treated with fluazifop-butyl (Fusilate 2000, 1 lb/gallon EC, ICI Americas) at 0.75 lb ai/A application (1.5 lb ai/A). The fluazifop-butyl concentration in the 0-6 inch soil depth was 0.05-0.16 ppm immediately after the first treatment, 0.40-0.18 ppm immediately after the second treatment, 0.11-0.29 ppm at 7 days, <0.01-0.04 ppm at 14 days, <0.01-0.07 at 28 days, and not detected <0.01-0.04 ppm at 60-90 days after the second treatment. Fluazifop-butyl was not detected below the 6 inch soil depth. The degradate dissipated with a registrant-calculated half-life of 42 days. Fluazifop residues in the 0-6 inch soil depth were 0.06-0.13 ppm immediately after the first treatment, 0.09-0.13 ppm immediately after the second treatment, 0.10-0.24 ppm at 14 days, 0.03-0.05 ppm at 60 days and 0.07 ppm at 90 days after the second treatment.

During the study period, the air temperature ranged from 48 to 104°F. The average soil temperature (2-inch) ranged from 63 to 98°F. Combined rainfall and irrigation was approximately 15.9 inches. The slope of the field was <1% and the depth to the water table was approximately 150 feet.

The Porterville California study was scientifically sound, but does not meet Subdivision N guidelines because the freezer storage stability data presented for fluazifop-butyl are not adequate (the freezer storage stability study was conducted for up to 1.25 months, the analytical samples were stored for up to 91 days) and the soil was not analyzed for the degradate 5-trifluouromethyl-pyrid-2-one, comprising up to 25% of the recovered radioactivity in the laboratory aerobic soil metabolism study. All major degradates must be monitored during the field dissipation study.

A9-4. Terrestrial; Wiebe 1989, MRID 41900605; Unacceptable (DER 10/26/1992); Supplemental (DER Addendum 1 8/12/2008)

Fluazifop-butyl dissipated with a registrant-calculated half-life of 1.5 days from plots of loam soil planted to cotton near Visalia, California, that were treated twice with fluazifop-butyl (Fusilade 2000, 1 lb/gallon EC, ICI Americas) at 0.75 lb ai/A/application (1.5 lb ai total). The fluazifop-butyl concentration in the 0-to 6-inch soil depth was 0.05-0.08 ppm immediately after the first treatment, 0.18-0.26 ppm immediately after the second treatment, 0.05-0.14 ppm at 1 day post treatment, 0.06-0.13 ppm at 2 days, aid was not detected (<0.01 ppm) after 7 days post treatment (after rototilling). Fluazifop-butyl was not detected deeper than the 6-inch soil depth. The soil was analyzed for two degradates: fluazifop-acid, which dissipated with a registrant-calculated half-life of 18 days; and degradate X, which dissipated with a registrant-calculated half-life of 108 days. Fluazifop-acid in the 0-6 inch soil depth was 0.05-0.17 ppm immediately after the first treatment, 0.08-0.21 ppm immediately after the second treatment, 0.02-0.12 ppm at 14 days post treatment, 0.01-0.11 ppm at 28 days, 0.01-0.04 ppm at 60 days, and not detected (~0.01 ppm) at 90 days. Fluazifop-acid was not detected deeper than the 6-inch soil depth. Degradate X was ~0.03 ppm in the 0- to 6- inch soil depth at all sampling intervals, and was not detected deeper than the 6-inch soil depth. During the study period, the air temperatures ranged from 23 to 104°F. The soil temperatures (8-inch depth) ranged from 38 to 97°F. Combined rainfall and irrigation was approximately 33 inches. The field was leveled before planting, and the depth to the water table was 10-25 feet (average 15 feet). This study was classified as unacceptable due to rototilling of the soil (DER 10/26/1992). This study was upgraded to supplemental because the data is scientifically valid and it provides information on the behavior of fluazifop-butyl in fields that are rototilled (DER Addendcum 1 8/12/2008). However, the study cannot be used to satisfy the guideline requirements and does not provide information on the leaching behavior of fluazifop-butyl and its degradates.

A9-5. Terrestrial; Wiebe 1990, MRID 41900606; Supplemental but unacceptable to fulfill guideline (A. Abramovitch; EFED Fate Summary 11/9/1992; DP Barcode D157692, D157723, D165770)

The 1989-1990 Porterville, California study (41900606) is unacceptable because the dissipation of the degradate 5-trifluoromethyl-pyrid-2-one (degradate X) does not agree with the data reported in the aerobic metabolism and mobility laboratory studies. In the aerobic metabolism study, 5-trifluoromethyl-pyrid-2-one comprised up to 25% of the recovered radioactivity (87-110% recovery of applied radioactivity). In this study, it was 4.4% of the recovered radioactivity. In the mobility study, degradate X did not adsorb to soil. In this study, it was not detected below the 6-inch depth. Supplemental data provided by this study indicates that fluazifop-butyl, applied twice at 0.75 lb ai/A (1.5 lb ai total) to sandy loam soil planted to cotton, dissipated with a registrant-calculated half-life of 13 days. Fluazifop-acid, its major degradate, dissipated with a half-life of 42 days. Degradate X dissipated with a registrant-calculated half-life of 241 days. Fluazifop-butyl residues did not leach below the 6-inch soil depth.

A9-6. Method Validation

Field dissipation studies require validation of the analytical methods used in the study (40 CFR §158.630). For the proposed action, studies for validation of analytical method to detect R and S enantiomers of fluazifop-butyl and fluazifop are needed. Also, a method to detect degradate X is needed as it also made up to greater than 10% of applied equivalents. Methods should be provided for soil and for water. An HPLC method was submitted to detect fluazifop-acid in water in connection with a ground water monitoring study but it has not been independently evaluated (MRID 40439402).

A10. Bioaccumulation/Bioconcentration Studies

A10-1. Bluegill Sunfish; Bull *et al* 1981, MRID 93796; Hamer 1990, MRID 92067035; Supplemental for fluazifop-butyl/fluazifop but does not fulfill guidelines (DER 10/26/1992)

Fluazifop-butyl residues accumulated in bluegill sunfish exposed to pyridyl and phenyl ring-labeled ^{14}C-fluazifop-butyl (radiochemical purities approximately 98%) at 6.8 μg/L for 28 days in a flow-through aquarium system. The maximum mean bioconcentration factors were 120X for edible tissues, 4800X for nonedible tissues, and 410X for whole fish. Mean concentrations of ^{14}C-residues were 1.6-2.8 mg/kg wet weight in whole fish, 0.17-0.82 mg/kg in edible tissue, and 9.1-32 mg/kg in viscera. In the viscera of the fish removed after 21 days of exposure, fluazifop-acid was 43-45% of the radioactivity in the sample. Unidentified polar residue(s) were approximately 45% of the radioactivity in the sample; the hydrolysis products of the polar residues were 2-(4-hydroxyphenoxy) propionic acid (III) and 5-trifluoromethyl-2-pyridone (X), each was present at 21-25% of the radioactivity in the sample.

During the depuration period, ^{14}C-residues in the muscle varied from 5.3 -17 μg/kg, with no discernable pattern, and ^{14}C-residues in the viscera declined from 1000 μg/kg at day one of the depuration period to 28-44 μg/kg at days 10-14 of the depuration period. In whole fish, ^{14}C residues declined from 1000 μg/kg at day one of the depuration period to 14-20 μg/kg at days 10-14 of the depuration period. In the water, total ^{14}C-residues ranged from 3.29-11.49 μg/L during the exposure period, of which 10-70% was fluazifop-butyl. Also in the water were 2-(4-hydroxyphenoxy)-5-trifluoromethyl pyridine (IV) at a maximum 11%; fluazifop-acid at 14-52%; and degradate X at a maximum 4%.

Uncharacterized residues in the water comprised 12-24% of the recovered (approximately 0.876-1.43 μg/L). Approximately 25% (approximately 1.3225-1.825 μg/L) of the ^{14}C residues in the water were volatilized during analysis and were therefore not identified. Throughout the study, the temperature of the treated water ranged from 16-20°C, the pH ranged from 7.2- 7.7, and the dissolved oxygen content was >90% saturation.

This study is scientifically sound, but does not meet Subdivision N guidelines because extractable degradates present in the viscera at approximately 45% of the sample radioactivity were not fully characterized, and ^{14}C residues in the edible tissues present at 0.17-0.82 mg/kg were not characterized (DER 10/26/1992). Guidelines call for all residues greater than 10% of the applied to be identified.

A10-2. Channel Catfish; Hamer et al. 1981, MRID 93795; Not classified – (summary from environmental fate review 03/24/1982)

Radiolabeled (^{14}C-phenyl and ^{14}C-pyridyl) fluazifop-butyl was applied at 0.5 kg ai/ha to a loamy sand soil. After 14 days aerobic incubation, the soil was flooded and channel catfish (*Ictalurus punctatus*) were added to the system for an exposure period of up to 65 days. After 28 and 65 days exposure, fish were transferred to flowing, uncontaminated water for 14 and 21 days, respectively. Soil, water, and fish (muscle, viscera, and whole fish) were analyzed for ^{14}C-residues at regular intervals.

During the initial 14 day aerobic incubation with soil, ^{14}C-residues decreased to approximately 80% of applied. At the end of this period fluazifop-butyl accounted for less than 1% of the applied radioactivity, the major degradation product being fluazifop-acid. Following flooding of the soil ^{14}C-residues in the water reached a plateau level of 32% of applied. The major degradation product identified was again fluazifop-acid. In the whole fish, the maximum bioconcentration factor (BCF=concentration in fish tissue/concentration in water) measured was 2.1, equal to 0.07 mg fluazifop equivalents/kg wet weight the maximum muscle and viscera bioconcentration factors were 1.1 and 8.0, respectively. The concentration of ^{14}C-residues in the fish fell rapidly during depuration with over 70% of the residues were eliminated during depuration.

During the study levels of fluazifop-acid in the water reached 0.024 mg/L during the exposure phase (equivalent to 23% of the radioactivity applied). Other characterized products were 2-(4-hydroxyphenoxy)-5-trifluoromethyl pyridine(<3% in soil) and 5-trifluoromethyl-2-pyridone (up to 7% in soil and 6% in water).

A11. Non-guideline Studies

A11-1. Effects of fluazifop-butyl on soil microbial processes. Castle *et al.* 1981, MRID 93790, Not Classified – Study summary from the EFED environmental review dated 03/24/1982.

Fluazifop-butyl was applied to two soils at rates equivalent to 0.5 and 5.0 kg/hectare (ha). Effects on the soil microbial community (determined by direct counts and ATP measurement) and on the carbon cycle (CO_2 release from unamended soils and soils amended with glucose or maize) were examined in laboratory-treated soils. Effects on the nitrogen cycle (ammonification and nitrification in soil amended with Lucerne) were examined in both laboratory and field-treated soil. After treated, the soils were incubated at 20°C with a moisture content of 40% of their moisture holding capacity at zero suction. In all these experiments fluazifop-butyl had no or only minor transitory effects. It is concluded that this herbicide will not affect the soil microbial community or microbial processes at the specified application rates.

A11-2. Effects of fluazifop-butyl on soil micro-organisms under field conditions. Castle *et al.* 1981, MRID 93791, Not classified – Study summary from the EFED environmental review dated 03/24/1982

Fluazifop-butyl was applied to field plots as an emulsifiable concentrate at 0.5 kg ai/ha. The treated and control plots were periodically treated with paraquat to control vegetration in order to minimize differences in the soil microflora which might be expected if treated and control plots had different plant cover. Effects on the microbial community (determined by direct count) and on their activity determined by ATP and initial glucose-stimulated respiration) and on cellulose degradation (using litter-bags) were examined. The study was carried out by sampling the plots at approximately monthly intervals for one year to assess the microbial community and by burying litter bags of cellulose in order to measure degradation rates under summer and winter conditions. No significant effects were detected, therefore, it is concluded that fluazifop-butyl will have no effect on the microbial community or cellulose degradation under field conditions.

A12. Ground Water

A ground water monitoring study for fluazifop-butyl (PC Code 122805 was requested in 1988 and a protocol was reviewed and rejected on 10/18/1988. A small scale groundwater study was submitted that sampled existing wells in Germany (MRID 40439401). A ground water monitoring study for fluazifop-butyl was requested in 1988 and a protocol was reviewed and rejected on 10/18/1988. A groundwater survey was completed in West Germany that analyzed 605 water samples from 95 raw water wells (MRID 40439401). No residues of fluazifop were found (limit of detection was 0.00008 mg/L).

The study was reviewed and determined to be unacceptable in fulfilling the groundwater monitoring guidelines (DER 12/12/1988).

In 1989, it was suggested that the groundwater monitoring study should be conducted under flooded conditions (PC Code 122805, Memo 1/31/1989).

In March 4, 1991, gtround water monitoring studies for fluazifop-p-butyl (PC Code 122809) were listed as held in reserve pending receipt of additional environmental fate data relevant to the environmental fate of fluazifop-butyl.

A12-1. Laws *et al.* 1987, MRID 40439401; Unacceptable (Environemntal fate review 2/12/1988)

A ground water survey was conducted in West Germany in 1985-1986 and was submitted to fulfill a requirement for a small-scale prospective ground water monitoring study. Water from 95 wells in seven states of the Federal Republic of Germany were sampled. Wells were selected when there were located near 1) farm areas where fluazifop-butyl is used, 2) ground water within 20 m of the soil surface, and 3) geologically vulnerable areas. Sampling was conducted over an 18 month period and 5-7 samples were collected at each well. Water was collected in 2.5 L amber glass bottled fitted with PTFE capes. The water was filtered to remove suspended solids. Standing water in the well was pumped prior to collection, although pH, temperature, and conductivity were not stabilized before sample collection. Samples were stored at 5°C prior to shipment at ambient temperature. Upon arrival at the laboratory for analysis, they were stored at 4±1°C. A sample of water was fortified, acidified to pH 1 and analyzed using an HPLC method.

The HPLC method to detect fluazifop in water (MRID 40439402) was submitted for review but an independent laboratory evaluation was not completed.

Environmental Fate MRID Studies

MRID Number	Reference
87491	Evans, J.D.H.L.; Cavell, B.D. (1980) PP009: Preliminary Hydrolysis Studies: Report Series RJ 0121B. (Unpublished study received Dec 4, 1981 under 10182-EX-27; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:246387-B)
87492	Arnold, D.J.; Rapley, J.H.; Weissler, M.S.; et al. (1980) PP009: Degradation in Soil under Aerobic and Flooded Conditions in the Laboratory: Report Series RJ 0131B. (Unpublished study received Dec 4, 1981 under 10182-EX-27; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:246387-D)
87493	Harvey, B.R.; Vincent, J.; Mistry, R.; et al. (1981) Fluazifop- butyl: Degradation in Soil: Report Series RJ 0197B. (Unpublished study received Dec 4, 1981 under 10182-EX-27; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:246387-E)
87495	Ussary, J.P.; Koubek, K.G.; Theodorakis, S.K.; et al. (1981) Fluazifop-butyl Dissipation in Soils: Report Series TMU0657/B. (Unpublished study received Dec 4, 1981 under 10182-EX-27; submitted by ICI Americas, Inc., Wilmington, Del.; CDL:246387-G)
87529	Makin, N.G.S.; Hignett, R.R.; Cavell, B.D. (1980) PP009: Hydrolysis of 14IC-PP009 in Sterile Aqueous Solution: Report Series RJO145B. (Unpublished study received Dec 4, 1981 under 10182-EX-27; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:246378-D)
93788	MacNeil, R.M.; Hignett, R.R.; Cavel, B.D. (1981) Fluazifop-butyl: Photolysis of ^14IC-Fluazifop-butyl in Sterile Aqueous Solutions: Report Series RJ 0176B. (Unpublished study received Jan 18, 1982 under 10182-66; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:070626-B)
93789	MacNeil, R.M.; Hignett, R.R.; Cavell, B.D. (1981) Fluazifop-butyl: Photodegradation of ^14IC-Fluazifop-butyl on a Soil Surface: Report Series RJ 0191B. (Unpublished study received Jan 18, 1982 under 10182-66; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:070626-C)
93790	Castle, D.L.; Slinger, J.M.; Askew, P.D.; et al. (1981) Fluazifop- butyl: Effects on Soil Microbial Processes: Report Series RJ 0210B. (Unpublished study received Jan 18, 1982 under 10182- 66; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:070626-D)
93791	Castle, D.L.; Davies, P.I.; Slinger, J.M.; et al. (1981) Fluazifop- butyl: Effects on Soil Micro-organisms under Field Conditions: Report Series RJ 0200B. (Unpublished study received Jan 18, 1982 under 10182-66; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:070626-E).
93794	Stevens, J.E.B.; Weissler, M.S.; Poole, N.J. (1981) Fluazifop- butyl and Fluazifop: Adsorption and Desorption in Soil: Report Series RJ 0219B. (Unpublished study received Jan 18, 1982 under 10182-66; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:070626-I)
93795	Hamer, M.J.; Woods, T.; Hill, I.R. (1981) Fluazifop-butyl: The Accumulation of Fluazifop-butyl and Its Degradation Products by Channel Catfish in a Model Soil/Water System: Report Series RJ 0201B. (Unpublished study received Jan 18, 1982 under 10182-66; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:070626-J)
93796	Bull, J.M.; Curl, E.A.; Hill, I.R. (1981) Fluazifop-butyl: Accumulation in Bluegill Sunfish in a Flow-through System: Report Series RJ 0202B. (Unpublished study received Jan 18, 1982 under 10182-66; prepared by Imperial Chemical Industries, Ltd., England, submitted by ICI Americas, Inc., Wilmington, Del.; CDL:070626-K)

MRID Number	Reference
162454	Bewick, D. (1982) Fluazifop: Stereochemistry of Residues Derived from the Hydrolysis of Fluazifop-butyl in Soil: Report Series: RJ 0270B. Unpublished study prepared by ICI Plant Protection Div. 28 p.
162455	Bewick, D. (1983) Fluazifop-butyl: Fate of the Separate R and S-- Enantiomers in Soil: Report Series: RJ 0306B. Unpublished study prepared by ICI Plant Protection Div., Jealotts Hill Research Station. 21 p.
40439401	Laws, I.; Johnen, B.; Earl, M. (1987) Fluazifop-butyl: Groundwater Survey in West Germany, 1985-1986: Laboratory Project ID: M4617B. Unpublished study prepared by ICI Protection Div. 30 p.
41598001	McCarron, E. and J. Heath. 1989. Fluazifop-p-butyl: Hydrolysis in sterile aqueous solution. Unpublished study performed by ICI Agrochemicals, Bracknell, UK and submitted by ICI Americas Inc. Wilmington, DE.
41598002	French, D.A. and K.K. Matharu. 1989. Fluazifop-p-butyl: Photodegradation on a soil surface. Unpublished study performed by ICI Agrochemicals, Bracknell, UK, and submitted by ICI Americas Inc., Wilmington, DE.
41598003	Wiebe, L. A. 1989. Fusilate 2000: Field dissipation study for terrestrial uses, Visalia California. Unpublished study performed and submitted by ICI Americas Inc., CA.
41598004	Wiebe, L.A. 1989. Fusilade 2000: Field dissipation study for terrestrial uses, Porterville, California. Unpublished study performed and submitted by ICI Americas Inc., Richmond, CA.
41900604	Lane, M.C.G., and P. Vaughn. 1991. Fluazifop-p-butyl: Adsorption and desorption of two soil metabolites, fluazifop and R154719. Study Report No: Report No. RJ0967B. Unpublished study performed by ICI Agrochemicals, Berkshire, UK, and submitted by ICI Americas Inc., Richmond, CA.
41900605	Wiebe, L.A. 1990. Fusilade 2000: Field dissipation study for terrestrial uses, Visalia, California, 1989-1990. Laboratory Project ID: Study No. FUSI-89-SD-01; Trial No. US02-89-211. Report No.RR 90-337B study performed and submitted by I C I Americas Inc., Richmond, CA.
41900606	Wiebe, L.A. 1990. Fusilade 2000: Field dissipation study for terrestrial uses, Porterville, California, 1989-1990. Laboratory Project ID: Study No. FUSI-89-SD-01; Trial No. 94CA-89-212.Report No. RR 90-338B. Unpublished study performed and submitted by I C I Americas Inc., Richmond, CA.
42543202	Jessup, K. M., Embury, G. T., and Leahey, J. P. 1991. Fluazifop-R-butyl: Photodegradation in aqueous solution at pH 5. Laboratory Project I.D.: RJ0992B. Unpublished study performed and submitted by ICI Agrochemicals, Bracknell, Berkshire, UK.
46190601	Goodyear, A. 1995. (14C)-Fluazifop-P: hydrolysis in sterile aqueous solution. Unpublished study performed by Hazelton Europe, North Yorkshire, England, and sponsored and submitted by Syngenta Crop Protection, Inc, Greensboro, NC. Laboratory ID: 38/187-1015. Experiment start date February 13, 1995 and completion date March 22, 1995 (p. 14). Final report issued on April 21, 1995.
46190602	Goodyear, A. 1998. (14C)-Fluazifop-P: soil degradation at 20°C. Unpublished study performed by Covance laboratories, Ltd, North Yorkshire, UK; sponsored and submitted by Syngenta Crop Protection, Inc., Greensboro, NC. Laboratory ID. 38/200-D2142. Experiment start date April 24, 1998, and completion date September 9, 1998 (p. 11). Final report issued October 16, 1998.
46190603	Goodyear, A. 1998. (14C)-Fluazifop-p: adsorption/desorption in soil. Unpublished study performed by Covance Laboratories Ltd., North Yorkshire, England; sponsored and submitted by Syngenta Crop Protection, Inc., Greensboro, NC. Laboratory Study Identification: Report Number 38/197-D2142. Experiment initiation July 14, 1998 and completion September 10, 1998 (p. 11). Final report issued October 27, 1998.
46190604	Ziegler, D.A. 1988. Adsorption of fluazifop-p-butyl to loamy sand, loam, silty clay loam, and silt loam. Unpublished study performed by Analytical Development Corporation, Colorado Springs, CO; sponsored and submitted by Syngenta Crop Protection, Inc., Greensboro, NC. Laboratory Study Identification: Project ID 1086. Study initiation November 1987 and termination February 1988 (p. 7). Final report issued September 21, 1988.

MRID Number	Reference
46190605	Purser D. 1999. (14C)-Fluazifop-p-butyl: degradation and retention in water sediment systems. Unpublished study performed by Covance Laboratories, North Yorkshire, England; submitted and sponsored by Syngenta Crop Protection, Inc., Greensboro, NC. Laboratory Report No.: 38/232-D2142. Experiment initiated February 22, 1999 and completed August 19, 1999 (p. 15). Final report issued October 29, 1999.
92067032	Leahey, J. (1990) ICI Americas Inc. Phase 3 Summary of MRID 00087493. Fluazifop-butyl: Degradation in Soil and a Comparison of the Microflora and Physicochemical Properties of Soils Used in UK Laboratory Studies with those of USA Soils: Report Nos. RJ0197B and RJ0429B; Study Nos. PP009AD02 and PP000CK10. Prepared by ICI Agrochemicals. 32 p.
92067033	Leahey, J. (1990) ICI Americas Inc. Phase 3 Summary of MRID 00087493. FLuazifop-butyl: Degradation in Soil and a Comparison of the Microflora and Physicochemicals Properties of Soils used in UK Laboratory Studies with those of USA Soils: Report Nos. RJ0192B and RJ0429B; Study Nos. PP009/ADOZ and PP000CK10. Prepared by ICI Agrochemicals. 27 p.
92067034	Iwata, Y. (1990) ICI Americas Inc. Phase 3 Summary of MRID 00087495. Fusilade: Field Dissipation Study for Terrestrial Uses: Laboratory Study ID. No. RR 90-207B. Prepared by ICI Americas, Inc. 15 p.
92067035	Hamer, M. (1990) ICI Americas Inc. Phase 3 Summary of MRID 00093796. Fluazifop-butyl: Accumulation in Bluegill Sunfish in a Flow-through System: Report No. RJ0202B Study No. PP009/CA/02. Prepared by ICI Agrochemicals. 21 p.
47272601	Sparrow, K.; Hipps, A. (2007) Physical and Chemical Properties of Fluazifop-P-Butyl Technical. Project Number: PC/07/052. Unpublished study prepared by Syngenta Crop Protection, Inc. 214 p.

Appendix B: Data Used to Determine Input Parameters for PRZM/EXAMS and PRZM/EXAMS Output Files

Table B 1. Summary of fluazifop-acid and fluazifop-p-acid aerobic soil data used to calculate the input value for PRZM/EXAMS.

MRID	status	chemical	Soil	Linear $t^{1/2}$
46190602	supplemental	fluazifop-p-acid	silt loam	10.5
46190602	supplemental	fluazifop-p-acid	sandy clay loam	9.8
46190602	supplemental	fluazifop-p-acid	sandy loam	7.5
46190602	supplemental	fluazifop-p-acid	sandy loam	13.9
46190602	supplemental	fluazifop-p-acid	sandy clay loam	9.6
46190602	supplemental	fluazifop-p-acid	clay loam	9.1
87493+92067032+92067033	supplemental	racemic parent + acid - phenyl label	sandy loam	39.2
	supplemental	racemic parent + acid -pyridyl label	sandy loam	48
	supplemental	racemic parent + acid - phenyl label	clay loam	39.8
	supplemental	racemic parent + acid - pyridyl label	clay loam	37
	supplemental	racemic parent + acid - phenyl label	loamy sand	33

Average	23
number of values = n	11
t90, alpha = 0.1 n-1 = 10	1.4
standard deviation	15.8
square root of n	3.3
Upper Confidence Bound	30

Table B 2. Summary of fluazifop-acid and fluazifop-p-acid aerobic water-sediment studies used to calculate the input value for PRZM/EXAMS.

MRID	status	chemical	Soil	Linear $t^{1/2}$
46190605	acceptable	fluazifop-p-acid	sand-phenyl	108
46190605	acceptable	fluazifop-p-acid	sand-pyridyl	13.7
46190605	acceptable	fluazifop-p-acid	sandy loam, phenyl	23.2

46190605	acceptable	fluazifop-p-acid	sandy loam, pyridyl	43.9
			average	47.2
			n=	4.0
			t90, alpha = 0.1; n-1 = 3	1.6
			standard deviation	42.4
			square root of n	2.0
			upper confidence bound	82.0

Table B 3. Summary of fluazifop-acid anaerobic flooded soil studies used to calculate the input value for PRZM/EXAMS.

MRID	status	chemical	Soil	Linear $t^{1/2}$
87493 92067032 92067033	Supplemental	racemic parent + acid - phenyl label	sandy loam	315
	Supplemental	racemic parent + acid pyridyl label	sandy loam	289
	Supplemental	racemic parent + acid - phenyl label	clay loam	1155
	Supplemental	racemic parent + acid - pyridyl label	clay loam	990
			Average	687.3
			number of values = n	4.0
			t90, alpha = 0.1 n-1 = 3	1.6
			standard deviation	450.0
			square root of n	2.0
			Upper Confidence Bound	1056

Table B 4. Summary of fluazifop-acid and fluazifop-p-acid sorption data used to calculate the input value for PRZM/EXAMS.

MRID No Status	Soil	%OC	%OM[1]	pH	K_F (L/kg)	K_{FOC} (L/kg)[5]	Log K_F (L/kg)	Log K_{FOC} (L/kg)
41900604 Acceptable	Sand	0.77	1.309	5.3	0.23	51	-0.64	1.71
	Sandy loam	3.1	5.27	6.1	0.14	13	-0.85	1.11
	Sandy loam	1.9	3.23	6	0.17	9.5	-0.77	0.98
	Clay	5.4	9.18	6.8	0.26	8.3	-0.59	0.92
46190603 Supplemental	Silt loam	1.9	3.23	7	0.8	40.1	-0.10	1.60
	Sandy clay loam	2.1	3.57	5.8	0.9	42.2	-0.05	1.63
	Sandy loam	2.2	3.74	7.2	38.5	22.3	1.59	1.35
	Sandy loam	0.9	1.53	5.3	0.8	83.6	-0.10	1.92

	Sandy clay loam	3.1	5.27	7.1	1.2	39.2	0.08	1.59
	Clay/loam loam	4.3	7.31	7.7	2.1	48.7	0.32	1.69

[1] %OM calculated as %OC x 1.7.

average	4.510	35.790
standard deviation	0.055	20.464
coefficient of variation	1%	57%
minimum	0.140	8.300
maximum	38.500	83.600
median	0.800	39.650

PRZM/EXAMS Output

Scenario: MIbeansSTD
Application Rate: 0.18
Number of Applications: 4
Aerial

Surface Water:
stored as MIbnair4.out
Chemical: Fluazifop-acid
PRZM environment: MIbeansSTD.txt modified Tueday, 29 May 2007 at 12:56:44
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w14826.dvf modified Wedday, 3 July 2002 at 09:05:38
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	4.561	4.5	4.346	4.133	3.885	1.703
1962	6.896	6.813	6.472	5.805	5.441	3.744
1963	5.852	5.787	5.607	5.298	5.155	4.088
1964	8.309	8.192	7.99	7.47	7.092	4.768
1965	5.841	5.772	5.498	5.03	4.856	4.421
1966	6.945	6.851	6.659	6.364	6.239	4.515
1967	7.169	7.084	6.913	6.602	6.411	4.839
1968	10.73	10.59	10.27	9.693	9.271	6.403
1969	8.587	8.504	8.301	7.595	7.149	6.02
1970	7.6	7.499	7.331	6.977	6.737	5.107
1971	7.771	7.677	7.42	6.918	6.52	4.922
1972	7.122	7.03	6.771	6.284	5.907	4.497
1973	4.23	4.218	4.166	4.05	3.951	3.323
1974	4.263	4.224	4.061	3.725	3.548	2.637
1975	8.508	8.437	8.059	7.445	7.11	4.575
1976	6.095	6.011	5.727	5.438	5.239	4.664
1977	6.222	6.172	5.934	5.773	5.512	3.968
1978	5.549	5.476	5.213	4.718	4.427	3.604
1979	6.726	6.65	6.507	6.186	5.861	4.02
1980	11.76	11.6	10.98	10.29	9.692	5.981
1981	8.107	7.996	7.651	7.12	6.82	6.008
1982	5.818	5.738	5.476	5.076	4.877	4.277
1983	7.444	7.328	7.028	6.26	5.792	3.968
1984	7.121	7.026	6.721	6.004	5.586	4.115
1985	4.502	4.442	4.223	4.078	3.953	3.425

```
1986   6.64  6.545 6.18  5.716 5.455 3.795
1987   5.223 5.141 4.897 4.515 4.26  3.562
1988   6.739 6.632 6.339 5.77  5.382 3.653
1989   8.375 8.277 8.109 7.408 7.036 4.973
1990   5.378 5.308 5.077 4.935 4.821 4.32

Sorted results
Prob. Peak  96 hr 21 Day       60 Day       90 Day       Yearly
0.032258064516129 11.76 11.6  10.98 10.29 9.692 6.403
0.0645161290322581       10.73 10.59 10.27 9.693 9.271 6.02
0.0967741935483871       8.587 8.504 8.301 7.595 7.149 6.008
0.129032258064516 8.508 8.437 8.109 7.47  7.11  5.981
0.161290322580645 8.375 8.277 8.059 7.445 7.092 5.107
0.193548387096774 8.309 8.192 7.99  7.408 7.036 4.973
0.225806451612903 8.107 7.996 7.651 7.12  6.82  4.922
0.258064516129032 7.771 7.677 7.42  6.977 6.737 4.839
0.290322580645161 7.6   7.499 7.331 6.918 6.52  4.768
0.32258064516129  7.444 7.328 7.028 6.602 6.411 4.664
0.354838709677419 7.169 7.084 6.913 6.364 6.239 4.575
0.387096774193548 7.122 7.03  6.771 6.284 5.907 4.515
0.419354838709677 7.121 7.026 6.721 6.26  5.861 4.497
0.451612903225806 6.945 6.851 6.659 6.186 5.792 4.421
0.483870967741936 6.896 6.813 6.507 6.004 5.586 4.32
0.516129032258065 6.739 6.65  6.472 5.805 5.512 4.277
0.548387096774194 6.726 6.632 6.339 5.773 5.455 4.115
0.580645161290323 6.64  6.545 6.18  5.77  5.441 4.088
0.612903225806452 6.222 6.172 5.934 5.716 5.382 4.02
0.645161290322581 6.095 6.011 5.727 5.438 5.239 3.968
0.67741935483871  5.852 5.787 5.607 5.298 5.155 3.968
0.709677419354839 5.841 5.772 5.498 5.076 4.877 3.795
0.741935483870968 5.818 5.738 5.476 5.03  4.856 3.744
0.774193548387097 5.549 5.476 5.213 4.935 4.821 3.653
0.806451612903226 5.378 5.308 5.077 4.718 4.427 3.604
0.838709677419355 5.223 5.141 4.897 4.515 4.26  3.562
0.870967741935484 4.561 4.5   4.346 4.133 3.953 3.425
0.903225806451613 4.502 4.442 4.223 4.078 3.951 3.323
0.935483870967742 4.263 4.224 4.166 4.05  3.885 2.637
0.967741935483871 4.23  4.218 4.061 3.725 3.548 1.703

0.1   8.5791        8.4973        8.2818        7.5825        7.1451        6.0053
                                  Average of yearly averages:   4.32983333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MIbnair4
Metfile:    w14826.dvf
PRZM scenario:     MIbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:     Fluazifop-acid
Description Variable Name     Value Units Comments
Molecular weight  mwt   327.3 g/mol
Henry's Law Const.       henry 1.55E-10    atm-m^3/mol
Vapor Pressure     vapr  2.81E-7     torr
Solubility  sol    7800  mg/L
Kd     Kd     0.26  mg/L
Koc    Koc          mg/L
```

```
Photolysis half-life    kdp    0      days  Half-life
Aerobic Aquatic Metabolism     kbacw 82     days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0      days  Halfife
Aerobic Soil Metabolism asm    30     days  Halfife
Hydrolysis: pH 5  0      days  Half-life
Hydrolysis: pH 7  0      days  Half-life
Hydrolysis: pH 9  0      days  Half-life
Method:      CAM   2      integer      See PRZM manual
Incorporation Depth:     DEPI  0      cm
Application Rate: TAPP  0.18  kg/ha
Application Efficiency: APPEFF       0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  07-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    14     days  Set to 0 or delete line for single app.
app. rate 1 apprate            kg/ha
Interval 2  interval    14     days  Set to 0 or delete line for single app.
app. rate 2 apprate            kg/ha
Interval 3  interval    14     days  Set to 0 or delete line for single app.
app. rate 3 apprate            kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF       none  none, monthly or total(average of
entire run)
```

Scenario: MIbeansSTD
Application Rate: 0.36
Number of Applications: 2
Aerial

Surface Water:

stored as MIbnair2.out
Chemical: Fluazifop-acid
PRZM environment: MIbeansSTD.txt   modified Tueday, 29 May 2007 at 12:56:44
EXAMS environment: pond298.exv   modified Thuday, 29 August 2002 at 16:33:30
Metfile: w14826.dvf   modified Wedday, 3 July 2002 at 09:05:38
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	2.841	2.804	2.677	2.58	2.504	1.192
1962	6.51	6.436	6.122	5.676	5.362	3.131
1963	7.025	6.94	6.579	6.272	5.964	4.029
1964	7.145	7.048	6.65	6.182	5.877	4.145
1965	4.292	4.238	4.109	3.797	3.634	3.156
1966	9.345	9.233	8.903	8.486	7.958	4.545
1967	9.543	9.423	8.968	8.109	7.548	5.359
1968	14.51	14.41	13.73	12.21	11.23	6.996
1969	9.69	9.567	9.103	8.108	7.531	6.162
1970	6.138	6.057	5.897	5.504	5.132	4.219
1971	5.99	5.917	5.678	5.245	4.915	3.497
1972	5.641	5.573	5.327	5.14	4.851	3.451

1973	3.847	3.801	3.663	3.307	3.106	2.561
1974	3.583	3.538	3.344	3.055	2.861	2.014
1975	11.58	11.44	10.88	9.635	8.853	4.594
1976	7.403	7.313	6.903	6.115	5.698	4.662
1977	9.296	9.223	8.724	7.666	7.044	4.552
1978	5.02	4.964	4.724	4.379	4.212	3.618
1979	7.896	7.821	7.433	6.611	6.104	3.797
1980	10.58	10.43	9.869	8.734	8.069	5.249
1981	7.504	7.401	7.034	6.573	6.203	4.956
1982	5.364	5.31	5.093	4.865	4.581	3.599
1983	6.345	6.255	5.887	5.194	4.736	3.185
1984	3.834	3.8	3.631	3.433	3.252	2.601
1985	3.495	3.449	3.301	3.079	2.881	2.121
1986	7.325	7.244	6.917	6.496	6.061	3.424
1987	4.655	4.593	4.336	3.872	3.613	3.01
1988	5.855	5.772	5.527	4.875	4.513	2.924
1989	9.858	9.746	9.386	8.672	8.097	4.886
1990	5.908	5.849	5.574	5.094	4.762	3.969

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	14.51	14.41	13.73	12.21	11.23	6.996
0.0645161290322581	11.58	11.44	10.88	9.635	8.853	6.162
0.0967741935483871	10.58	10.43	9.869	8.734	8.097	5.359
0.129032258064516	9.858	9.746	9.386	8.672	8.069	5.249
0.161290322580645	9.69	9.567	9.103	8.486	7.958	4.956
0.193548387096774	9.543	9.423	8.968	8.109	7.548	4.886
0.225806451612903	9.345	9.233	8.903	8.108	7.531	4.662
0.258064516129032	9.296	9.223	8.724	7.666	7.044	4.594
0.290322580645161	7.896	7.821	7.433	6.611	6.203	4.552
0.32258064516129	7.504	7.401	7.034	6.573	6.104	4.545
0.354838709677419	7.403	7.313	6.917	6.496	6.061	4.219
0.387096774193548	7.325	7.244	6.903	6.272	5.964	4.145
0.419354838709677	7.145	7.048	6.65	6.182	5.877	4.029
0.451612903225806	7.025	6.94	6.579	6.115	5.698	3.969
0.483870967741936	6.51	6.436	6.122	5.676	5.362	3.797
0.516129032258065	6.345	6.255	5.897	5.504	5.132	3.618
0.548387096774194	6.138	6.057	5.887	5.245	4.915	3.599
0.580645161290323	5.99	5.917	5.678	5.194	4.851	3.497
0.612903225806452	5.908	5.849	5.574	5.14	4.762	3.451
0.645161290322581	5.855	5.772	5.527	5.094	4.736	3.424
0.67741935483871	5.641	5.573	5.327	4.875	4.581	3.185
0.709677419354839	5.364	5.31	5.093	4.865	4.513	3.156
0.741935483870968	5.02	4.964	4.724	4.379	4.212	3.131
0.774193548387097	4.655	4.593	4.336	3.872	3.634	3.01
0.806451612903226	4.292	4.238	4.109	3.797	3.613	2.924
0.838709677419355	3.847	3.801	3.663	3.433	3.252	2.601
0.870967741935484	3.834	3.8	3.631	3.307	3.106	2.561
0.903225806451613	3.583	3.538	3.344	3.079	2.881	2.121
0.935483870967742	3.495	3.449	3.301	3.055	2.861	2.014
0.967741935483871	2.841	2.804	2.677	2.58	2.504	1.192
0.1	10.5078	10.3616	9.8207	8.7278	8.0942	5.348

Average of yearly averages: 3.85346666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MIbnair2
Metfile: w14826.dvf
PRZM scenario: MIbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid
Description Variable Name Value Units Comments
Molecular weight mwt 327.3 g/mol
Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L
Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.36 kg/ha
Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 07-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: ILbeanNMC
Application Rate: 0.18
Number of Applications: 4
Aerial

Surface Water:
stored as ILbnair4.out
Chemical: Fluazifop-acid
PRZM environment: ILbeansNMC.txt modified Thuday, 14 June 2007 at 10:16:26
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w14842.dvf modified Wedday, 3 July 2002 at 09:04:38
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	9.498	9.361	8.826	8.224	7.685	3.195
1962	7.011	6.909	6.6	6.063	5.753	4.891
1963	7.46	7.361	7.173	7.024	6.697	4.769
1964	5.27	5.196	4.977	4.54	4.308	3.772

1965	9.738	9.604	9.066	8.224	7.714	4.619
1966	11.09	10.95	10.42	9.759	9.233	6.243
1967	9.09	8.984	8.666	8.057	7.605	6.151
1968	9.106	8.972	8.711	8.238	7.798	5.723
1969	12.05	11.88	11.17	9.974	9.361	6.324
1970	8.925	8.822	8.458	7.755	7.249	6.08
1971	9.384	9.257	8.743	8.282	7.915	5.593
1972	6.774	6.681	6.558	6.119	5.808	4.906
1973	10.53	10.37	9.923	8.967	8.391	5.387
1974	5.768	5.751	5.68	5.522	5.388	4.23
1975	12.31	12.12	11.61	11.15	10.57	5.588
1976	8.365	8.287	8.039	7.479	7.092	6.36
1977	10.24	10.16	9.633	8.613	8.064	5.601
1978	6.575	6.474	6.257	5.893	5.648	4.926
1979	7.473	7.365	7.16	6.431	5.976	4.128
1980	5.224	5.151	4.88	4.451	4.172	3.606
1981	15.92	15.69	15.26	13.75	12.86	6.857
1982	9.524	9.395	9.27	9.01	8.802	7.613
1983	7.67	7.524	7.226	6.435	6.152	5.199
1984	5.014	4.935	4.778	4.37	4.163	3.494
1985	5.071	5.006	4.751	4.369	4.143	3.073
1986	6.476	6.394	6.13	5.911	5.649	3.841
1987	5.691	5.607	5.373	5.147	4.875	3.868
1988	3.66	3.65	3.605	3.504	3.421	2.633
1989	3.528	3.494	3.425	3.207	3.069	2.133
1990	15.82	15.59	15.2	14.61	13.79	7.035

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	15.92	15.69	15.26	14.61	13.79	7.613
0.0645161290322581	15.82	15.59	15.2	13.75	12.86	7.035
0.0967741935483871	12.31	12.12	11.61	11.15	10.57	6.857
0.129032258064516	12.05	11.88	11.17	9.974	9.361	6.36
0.161290322580645	11.09	10.95	10.42	9.759	9.233	6.324
0.193548387096774	10.53	10.37	9.923	9.01	8.802	6.243
0.225806451612903	10.24	10.16	9.633	8.967	8.391	6.151
0.258064516129032	9.738	9.604	9.27	8.613	8.064	6.08
0.290322580645161	9.524	9.395	9.066	8.282	7.915	5.723
0.32258064516129	9.498	9.361	8.826	8.238	7.798	5.601
0.354838709677419	9.384	9.257	8.743	8.224	7.714	5.593
0.387096774193548	9.106	8.984	8.711	8.224	7.685	5.588
0.419354838709677	9.09	8.972	8.666	8.057	7.605	5.387
0.451612903225806	8.925	8.822	8.458	7.755	7.249	5.199
0.483870967741936	8.365	8.287	8.039	7.479	7.092	4.926
0.516129032258065	7.67	7.524	7.226	7.024	6.697	4.906
0.548387096774194	7.473	7.365	7.173	6.435	6.152	4.891
0.580645161290323	7.46	7.361	7.16	6.431	5.976	4.769
0.612903225806452	7.011	6.909	6.6	6.119	5.808	4.619
0.645161290322581	6.774	6.681	6.558	6.063	5.753	4.23
0.67741935483871	6.575	6.474	6.257	5.911	5.649	4.128
0.709677419354839	6.476	6.394	6.13	5.893	5.648	3.868
0.741935483870968	5.768	5.751	5.68	5.522	5.388	3.841
0.774193548387097	5.691	5.607	5.373	5.147	4.875	3.772
0.806451612903226	5.27	5.196	4.977	4.54	4.308	3.606
0.838709677419355	5.224	5.151	4.88	4.451	4.172	3.494
0.870967741935484	5.071	5.006	4.778	4.37	4.163	3.195
0.903225806451613	5.014	4.935	4.751	4.369	4.143	3.073

```
0.935483870967742 3.66  3.65  3.605 3.504 3.421 2.633
0.967741935483871 3.528 3.494 3.425 3.207 3.069 2.133

0.1   12.284      12.096      11.566      11.0324     10.4491     6.8073
                              Average of yearly averages:   4.92793333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ILbnair4
Metfile:    w14842.dvf
PRZM scenario:     ILbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name:     Fluazifop-acid
Description Variable Name     Value Units Comments
Molecular weight  mwt    327.3 g/mol
Henry's Law Const.       henry 1.55E-10    atm-m^3/mol
Vapor Pressure    vapr   2.81E-7     torr
Solubility  sol   7800   mg/L
Kd    Kd    0.26  mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp    0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 82    days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0     days  Halfife
Aerobic Soil Metabolism asm    30    days  Halfife
Hydrolysis: pH 5  0      days  Half-life
Hydrolysis: pH 7  0      days  Half-life
Hydrolysis: pH 9  0      days  Half-life
Method:      CAM    2      integer     See PRZM manual
Incorporation Depth:     DEPI  0     cm
Application Rate: TAPP  0.18  kg/ha
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    14     days  Set to 0 or delete line for single app.
app. rate 1 apprate            kg/ha
Interval 2  interval    14     days  Set to 0 or delete line for single app.
app. rate 2 apprate            kg/ha
Interval 3  interval    14     days  Set to 0 or delete line for single app.
app. rate 3 apprate            kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Scenario: ILbeansNMC
Application Rate: 0.36
Number of Applications: 2
Aerial

Surface Water:
stored as ILbnair2.out

Chemical: Fluazifop-acid
PRZM environment: ILbeansNMC.txt modified Thuday, 14 June 2007 at 10:16:26
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w14842.dvf modified Wedday, 3 July 2002 at 09:04:38
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	6.483	6.389	6.033	5.387	5.045	2.2
1962	6.748	6.654	6.296	5.683	5.306	3.633
1963	11.61	11.43	10.82	9.537	8.775	4.989
1964	5.406	5.391	5.325	5.177	5.061	3.746
1965	4.209	4.146	4.076	3.738	3.49	2.454
1966	7.678	7.54	7.138	6.36	5.925	3.41
1967	6.879	6.784	6.6	5.989	5.58	4.187
1968	14.36	14.15	13.54	11.93	11.1	6.354
1969	13.78	13.56	12.91	11.36	10.41	7.245
1970	6.64	6.621	6.539	6.358	6.218	4.909
1971	11.61	11.45	10.83	9.582	8.772	4.983
1972	7.28	7.198	6.909	6.231	5.798	4.69
1973	7.741	7.62	7.221	6.347	5.92	4.097
1974	5.107	5.021	4.763	4.211	3.899	3.235
1975	8.972	8.835	8.286	7.263	6.735	3.879
1976	7.656	7.535	7.325	6.956	6.568	4.75
1977	7.064	6.954	6.539	5.795	5.344	4.098
1978	8.605	8.472	7.938	6.921	6.304	4.132
1979	6.692	6.596	6.389	5.782	5.346	3.927
1980	3.743	3.676	3.512	3.415	3.339	2.784
1981	14.47	14.24	13.36	11.76	11.01	5.691
1982	10.71	10.53	9.859	9.008	8.354	6.525
1983	9.091	8.918	8.334	8.008	7.409	5.288
1984	5.891	5.805	5.626	4.967	4.57	3.763
1985	5.653	5.567	5.227	4.778	4.485	3.075
1986	8.864	8.754	8.188	7.2	6.623	3.981
1987	4.339	4.276	4.092	3.972	3.866	3.269
1988	2.904	2.85	2.639	2.313	2.253	1.887
1989	3.561	3.505	3.294	2.914	2.717	1.734
1990	16.49	16.27	15.53	13.95	12.91	6.221

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	16.49	16.27	15.53	13.95	12.91	7.245
0.0645161290322581	14.47	14.24	13.54	11.93	11.1	6.525
0.0967741935483871	14.36	14.15	13.36	11.76	11.01	6.354
0.129032258064516	13.78	13.56	12.91	11.36	10.41	6.221
0.161290322580645	11.61	11.45	10.83	9.582	8.775	5.691
0.193548387096774	11.61	11.43	10.82	9.537	8.772	5.288
0.225806451612903	10.71	10.53	9.859	9.008	8.354	4.989
0.258064516129032	9.091	8.918	8.334	8.008	7.409	4.983
0.290322580645161	8.972	8.835	8.286	7.263	6.735	4.909
0.32258064516129	8.864	8.754	8.188	7.2	6.623	4.75
0.354838709677419	8.605	8.472	7.938	6.956	6.568	4.69
0.387096774193548	7.741	7.62	7.325	6.921	6.304	4.187
0.419354838709677	7.678	7.54	7.221	6.36	6.218	4.132
0.451612903225806	7.656	7.535	7.138	6.358	5.925	4.098
0.483870967741936	7.28	7.198	6.909	6.347	5.92	4.097
0.516129032258065	7.064	6.954	6.6	6.231	5.798	3.981

0.548387096774194	6.879	6.784	6.539	5.989	5.58	3.927
0.580645161290323	6.748	6.654	6.539	5.795	5.346	3.879
0.612903225806452	6.692	6.621	6.389	5.782	5.344	3.763
0.645161290322581	6.64	6.596	6.296	5.683	5.306	3.746
0.67741935483871	6.483	6.389	6.033	5.387	5.061	3.633
0.709677419354839	5.891	5.805	5.626	5.177	5.045	3.41
0.741935483870968	5.653	5.567	5.325	4.967	4.57	3.269
0.774193548387097	5.406	5.391	5.227	4.778	4.485	3.235
0.806451612903226	5.107	5.021	4.763	4.211	3.899	3.075
0.838709677419355	4.339	4.276	4.092	3.972	3.866	2.784
0.870967741935484	4.209	4.146	4.076	3.738	3.49	2.454
0.903225806451613	3.743	3.676	3.512	3.415	3.339	2.2
0.935483870967742	3.561	3.505	3.294	2.914	2.717	1.887
0.967741935483871	2.904	2.85	2.639	2.313	2.253	1.734

0.1 14.302 14.091 13.315 11.72 10.95 6.3407
Average of yearly averages: 4.1712

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ILbnair2
Metfile: w14842.dvf
PRZM scenario: ILbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid
Description Variable Name Value Units Comments
Molecular weight mwt 327.3 g/mol
Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L
Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.36 kg/ha
Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: ORsnbeansSTD
Application Rate: 0.18
Number of Applications: 4
Aerial

Surface Water:
stored as ORbnair4.out
Chemical: Fluazifop-acid
PRZM environment: ORsnbeansSTD.txt modified Tueday, 29 May 2007 at 13:01:06
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	2.039	2.013	1.91	1.754	1.674	0.7541
1962	2.239	2.216	2.12	1.961	1.934	1.409
1963	2.421	2.396	2.291	2.135	2.071	1.574
1964	2.362	2.338	2.24	2.103	2.056	1.57
1965	2.374	2.347	2.237	2.076	2.023	1.601
1966	2.42	2.393	2.279	2.117	2.046	1.602
1967	2.3	2.268	2.141	1.97	1.883	1.46
1968	3.706	3.677	3.535	3.266	3.11	1.882
1969	10.4	10.3	9.954	9.401	9.049	4.448
1970	7.788	7.754	7.614	7.292	7.042	5.396
1971	8.934	8.871	8.568	7.986	7.639	4.764
1972	6.27	6.246	6.146	5.912	5.715	4.408
1973	3.221	3.189	3.087	2.978	2.9	2.573
1974	2.868	2.835	2.701	2.522	2.403	1.998
1975	2.472	2.448	2.367	2.286	2.208	1.705
1976	2.649	2.622	2.578	2.427	2.326	1.723
1977	3.914	3.864	3.695	3.486	3.335	2.121
1978	3.843	3.812	3.736	3.525	3.403	2.588
1979	4.653	4.608	4.42	4.08	3.9	2.716
1980	3.189	3.166	3.12	3.007	2.912	2.515
1981	3.184	3.159	3.071	2.906	2.811	2.015
1982	2.941	2.908	2.821	2.721	2.688	2.265
1983	5.247	5.2	4.998	4.609	4.385	2.753
1984	4.363	4.323	4.156	3.876	3.715	3.083
1985	3.111	3.101	3.06	2.961	2.876	2.499
1986	3.013	2.975	2.818	2.649	2.635	2.028
1987	5.578	5.511	5.378	5.03	4.721	2.838
1988	3.344	3.331	3.277	3.151	3.048	2.676
1989	2.877	2.847	2.722	2.531	2.446	2.027
1990	2.454	2.423	2.301	2.136	2.031	1.66

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	10.4	10.3	9.954	9.401	9.049	5.396
0.0645161290322581	8.934	8.871	8.568	7.986	7.639	4.764
0.0967741935483871	7.788	7.754	7.614	7.292	7.042	4.448
0.129032258064516	6.27	6.246	6.146	5.912	5.715	4.408
0.161290322580645	5.578	5.511	5.378	5.03	4.721	3.083
0.193548387096774	5.247	5.2	4.998	4.609	4.385	2.838
0.225806451612903	4.653	4.608	4.42	4.08	3.9	2.753
0.258064516129032	4.363	4.323	4.156	3.876	3.715	2.716

```
0.290322580645161 3.914 3.864 3.736 3.525 3.403 2.676
0.32258064516129  3.843 3.812 3.695 3.486 3.335 2.588
0.354838709677419 3.706 3.677 3.535 3.266 3.11  2.573
0.387096774193548 3.344 3.331 3.277 3.151 3.048 2.515
0.419354838709677 3.221 3.189 3.12  3.007 2.912 2.499
0.451612903225806 3.189 3.166 3.087 2.978 2.9   2.265
0.483870967741936 3.184 3.159 3.071 2.961 2.876 2.121
0.516129032258065 3.111 3.101 3.06  2.906 2.811 2.028
0.548387096774194 3.013 2.975 2.821 2.721 2.688 2.027
0.580645161290323 2.941 2.908 2.818 2.649 2.635 2.015
0.612903225806452 2.877 2.847 2.722 2.531 2.446 1.998
0.645161290322581 2.868 2.835 2.701 2.522 2.403 1.882
0.67741935483871  2.649 2.622 2.578 2.427 2.326 1.723
0.709677419354839 2.472 2.448 2.367 2.286 2.208 1.705
0.741935483870968 2.454 2.423 2.301 2.136 2.071 1.66
0.774193548387097 2.421 2.396 2.291 2.135 2.056 1.602
0.806451612903226 2.42  2.393 2.279 2.117 2.046 1.601
0.838709677419355 2.374 2.347 2.24  2.103 2.031 1.574
0.870967741935484 2.362 2.338 2.237 2.076 2.023 1.57
0.903225806451613 2.3   2.268 2.141 1.97  1.934 1.46
0.935483870967742 2.239 2.216 2.12  1.961 1.883 1.409
0.967741935483871 2.039 2.013 1.91  1.754 1.674 0.7541

0.1   7.6362      7.6032      7.4672      7.154 6.9093      4.444
                              Average of yearly averages:   2.42170333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORbnair4
Metfile:    w24232.dvf
PRZM scenario:     ORsnbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:     Fluazifop-acid
Description Variable Name     Value Units Comments
Molecular weight  mwt   327.3 g/mol
Henry's Law Const.      henry 1.55E-10    atm-m^3/mol
Vapor Pressure    vapr  2.81E-7     torr
Solubility  sol   7800  mg/L
Kd    Kd    0.26  mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 82    days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0     days  Halfife
Aerobic Soil Metabolism asm   30    days  Halfife
Hydrolysis: pH 5  0     days  Half-life
Hydrolysis: pH 7  0     days  Half-life
Hydrolysis: pH 9  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.18  kg/ha
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    14    days  Set to 0 or delete line for single app.
app. rate 1 apprate           kg/ha
Interval 2  interval    14    days  Set to 0 or delete line for single app.
```

app. rate 2 apprate kg/ha
interval 3 interval 14 days Set to 0 or delete line for single app.
app. rate 3 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: ORsnbeanSTD
Application Rate: 0.36
Number of Applications: 2
Aerial

Surface Water:
stored as ORbnair2.out
Chemical: Fluazifop-acid
PRZM environment: ORsnbeansSTD.txt modified Tueday, 29 May 2007 at 13:01:06
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	2.778	2.745	2.611	2.331	2.167	0.9457
1962	2.563	2.536	2.424	2.195	2.057	1.505
1963	2.572	2.547	2.445	2.222	2.076	1.489
1964	2.509	2.48	2.363	2.134	2.013	1.446
1965	2.525	2.495	2.372	2.127	1.989	1.455
1966	2.523	2.495	2.382	2.144	2.003	1.444
1967	2.459	2.429	2.308	2.046	1.902	1.355
1968	2.432	2.415	2.321	2.179	2.171	1.499
1969	7.504	7.434	7.2	6.795	6.542	3.703
1970	5.636	5.612	5.511	5.279	5.099	4.069
1971	6.596	6.557	6.33	5.897	5.646	3.911
1972	4.636	4.618	4.545	4.372	4.227	3.423
1973	3.09	3.053	2.905	2.679	2.585	2.14
1974	2.992	2.963	2.889	2.633	2.444	1.8
1975	2.634	2.605	2.483	2.265	2.138	1.571
1976	3.03	2.997	2.863	2.608	2.449	1.654
1977	2.977	2.939	2.819	2.64	2.52	1.851
1978	4.29	4.237	4.021	3.682	3.46	2.317
1979	3.174	3.143	3.017	2.785	2.723	2.27
1980	3	2.966	2.827	2.557	2.418	1.926
1981	2.604	2.576	2.462	2.246	2.171	1.696
1982	3.131	3.097	2.957	2.663	2.546	1.923
1983	4.201	4.167	3.987	3.709	3.497	2.226
1984	3.053	3.018	2.894	2.697	2.667	2.189
1985	2.974	2.935	2.777	2.483	2.359	1.928
1986	3.649	3.611	3.458	3.111	2.922	1.928
1987	9.135	9.04	8.641	7.747	7.205	3.778
1988	4.747	4.729	4.652	4.473	4.327	3.491
1989	3.326	3.291	3.147	2.89	2.725	2.158

1990 2.709 2.674 2.532 2.251 2.114 1.613

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	9.135	9.04	8.641	7.747	7.205	4.069
0.0645161290322581	7.504	7.434	7.2	6.795	6.542	3.911
0.0967741935483871	6.596	6.557	6.33	5.897	5.646	3.778
0.129032258064516	5.636	5.612	5.511	5.279	5.099	3.703
0.161290322580645	4.747	4.729	4.652	4.473	4.327	3.491
0.193548387096774	4.636	4.618	4.545	4.372	4.227	3.423
0.225806451612903	4.29	4.237	4.021	3.709	3.497	2.317
0.258064516129032	4.201	4.167	3.987	3.682	3.46	2.27
0.290322580645161	3.649	3.611	3.458	3.111	2.922	2.226
0.32258064516129	3.326	3.291	3.147	2.89	2.725	2.189
0.354838709677419	3.174	3.143	3.017	2.785	2.723	2.158
0.387096774193548	3.131	3.097	2.957	2.697	2.667	2.14
0.419354838709677	3.09	3.053	2.905	2.679	2.585	1.928
0.451612903225806	3.053	3.018	2.894	2.663	2.546	1.928
0.483870967741936	3.03	2.997	2.889	2.64	2.52	1.926
0.516129032258065	3	2.966	2.863	2.633	2.449	1.923
0.548387096774194	2.992	2.963	2.827	2.608	2.444	1.851
0.580645161290323	2.977	2.939	2.819	2.557	2.418	1.8
0.612903225806452	2.974	2.935	2.777	2.483	2.359	1.696
0.645161290322581	2.778	2.745	2.611	2.331	2.171	1.654
0.67741935483871	2.709	2.674	2.532	2.265	2.171	1.613
0.709677419354839	2.634	2.605	2.483	2.251	2.167	1.571
0.741935483870968	2.604	2.576	2.462	2.246	2.138	1.505
0.774193548387097	2.572	2.547	2.445	2.222	2.114	1.499
0.806451612903226	2.563	2.536	2.424	2.195	2.076	1.489
0.838709677419355	2.525	2.495	2.382	2.179	2.057	1.455
0.870967741935484	2.523	2.495	2.372	2.144	2.013	1.446
0.903225806451613	2.509	2.48	2.363	2.134	2.003	1.444
0.935483870967742	2.459	2.429	2.321	2.127	1.989	1.355
0.967741935483871	2.432	2.415	2.308	2.046	1.902	0.9457

0.1 6.5 6.4625 6.2481 5.8352 5.5913 3.7705

Average of yearly averages: 2.15679

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:

Output File: ORbnair2

Metfile: w24232.dvf

PRZM scenario: ORsnbeansSTD.txt

EXAMS environment file: pond298.exv

Chemical Name: Fluazifop-acid

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	327.3	g/mol	
Henry's Law Const.	henry	1.55E-10	atm-m^3/mol	
Vapor Pressure	vapr	2.81E-7	torr	
Solubility	sol	7800	mg/L	
Kd	Kd	0.26	mg/L	
Koc	Koc		mg/L	
Photolysis half-life	kdp	0	days	Half-life
Aerobic Aquatic Metabolism	kbacw	82	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	0	days	Halfife
Aerobic Soil Metabolism	asm	30	days	Halfife

Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.36 kg/ha
Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: WAbeansNMC
Application Rate: 0.18
Number of Applications: 4
Aerial

Surface Water:
stored as WAbnair4.out
Chemical: Fluazifop-acid
PRZM environment: WAbeansNMC.txt modified Thuday, 14 June 2007 at 10:18:32
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24243.dvf modified Wedday, 3 July 2002 at 09:06:34
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.54	1.516	1.42	1.271	1.209	0.5416
1962	2.006	1.983	1.888	1.734	1.655	1.139
1963	2.214	2.186	2.07	1.903	1.794	1.334
1964	2.225	2.202	2.107	1.953	1.865	1.385
1965	2.228	2.2	2.087	1.929	1.835	1.414
1966	2.224	2.192	2.064	1.893	1.784	1.347
1967	2.091	2.059	1.927	1.76	1.658	1.241
1968	2.554	2.525	2.419	2.235	2.149	1.458
1969	2.378	2.349	2.234	2.071	1.969	1.63
1970	2.18	2.15	2.028	1.869	1.775	1.403
1971	2.159	2.126	1.995	1.858	1.78	1.359
1972	2.199	2.168	2.044	1.884	1.79	1.378
1973	2.135	2.107	1.993	1.834	1.735	1.33
1974	2.169	2.14	2.02	1.855	1.751	1.31
1975	3.897	3.852	3.67	3.354	3.186	1.874
1976	2.83	2.797	2.666	2.491	2.388	2.135
1977	2.344	2.307	2.159	1.989	1.893	1.559
1978	2.199	2.172	2.062	1.905	1.811	1.394
1979	2.154	2.124	2.003	1.839	1.739	1.344
1980	2.141	2.116	2.013	1.855	1.758	1.306

1981	2.155	2.122	1.991	1.825	1.73	1.307
1982	2.547	2.515	2.387	2.219	2.119	1.506
1983	2.3	2.268	2.141	1.976	1.876	1.482
1984	2.227	2.198	2.082	1.923	1.825	1.401
1985	2.142	2.117	2.015	1.866	1.786	1.386
1986	2.797	2.781	2.695	2.537	2.448	1.656
1987	2.556	2.524	2.391	2.22	2.117	1.831
1988	2.288	2.259	2.144	1.984	1.884	1.48
1989	2.213	2.187	2.08	1.92	1.823	1.392
1990	6.197	6.114	5.795	5.258	4.994	2.516

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	6.197	6.114	5.795	5.258	4.994	2.516
0.0645161290322581	3.897	3.852	3.67	3.354	3.186	2.135
0.0967741935483871	2.83	2.797	2.695	2.537	2.448	1.874
0.129032258064516	2.797	2.781	2.666	2.491	2.388	1.831
0.161290322580645	2.556	2.525	2.419	2.235	2.149	1.656
0.193548387096774	2.554	2.524	2.391	2.22	2.119	1.63
0.225806451612903	2.547	2.515	2.387	2.219	2.117	1.559
0.258064516129032	2.378	2.349	2.234	2.071	1.969	1.506
0.290322580645161	2.344	2.307	2.159	1.989	1.893	1.482
0.32258064516129	2.3	2.268	2.144	1.984	1.884	1.48
0.354838709677419	2.288	2.259	2.141	1.976	1.876	1.458
0.387096774193548	2.228	2.202	2.107	1.953	1.865	1.414
0.419354838709677	2.227	2.2	2.087	1.929	1.835	1.403
0.451612903225806	2.225	2.198	2.082	1.923	1.825	1.401
0.483870967741936	2.224	2.192	2.08	1.92	1.823	1.394
0.516129032258065	2.214	2.187	2.07	1.905	1.811	1.392
0.548387096774194	2.213	2.186	2.064	1.903	1.794	1.386
0.580645161290323	2.199	2.172	2.062	1.893	1.79	1.385
0.612903225806452	2.199	2.168	2.044	1.884	1.786	1.378
0.645161290322581	2.18	2.15	2.028	1.869	1.784	1.359
0.67741935483871	2.169	2.14	2.02	1.866	1.78	1.347
0.709677419354839	2.159	2.126	2.015	1.858	1.775	1.344
0.741935483870968	2.155	2.124	2.013	1.855	1.758	1.334
0.774193548387097	2.154	2.122	2.003	1.855	1.751	1.33
0.806451612903226	2.142	2.117	1.995	1.839	1.739	1.31
0.838709677419355	2.141	2.116	1.993	1.834	1.735	1.307
0.870967741935484	2.135	2.107	1.991	1.825	1.73	1.306
0.903225806451613	2.091	2.059	1.927	1.76	1.658	1.241
0.935483870967742	2.006	1.983	1.888	1.734	1.655	1.139
0.967741935483871	1.54	1.516	1.42	1.271	1.209	0.5416
0.1	2.8267	2.7954	2.6921	2.5324	2.442	1.8697

Average of yearly averages: 1.46128666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: WAbnair4
Metfile: w24243.dvf
PRZM scenario: WAbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	327.3	g/mol	

Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L
Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.18 kg/ha
Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Interval 2 interval 14 days Set to 0 or delete line for single app.
app. rate 2 apprate kg/ha
Interval 3 interval 14 days Set to 0 or delete line for single app.
app. rate 3 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: WAbeansNMC
Application Rate: 0.36
Number of Applications: 2
Aerial

Surface Water:
stored as WAbnair2.out
Chemical: Fluazifop-acid
PRZM environment: WAbeansNMC.txt modified Thuday, 14 June 2007 at 10:18:32
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24243.dvf modified Wedday, 3 July 2002 at 09:06:34
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.714	1.687	1.58	1.367	1.252	0.5536
1962	2.194	2.164	2.042	1.815	1.681	1.091
1963	2.4	2.371	2.252	2.002	1.856	1.274
1964	2.422	2.391	2.266	2.033	1.899	1.334
1965	2.453	2.419	2.281	2.018	1.886	1.359
1966	2.425	2.395	2.272	2.005	1.86	1.298
1967	2.331	2.296	2.154	1.869	1.732	1.195
1968	2.303	2.27	2.135	1.958	1.915	1.319

1969	2.501	2.468	2.332	2.073	1.938	1.445
1970	2.396	2.359	2.212	1.934	1.805	1.309
1971	2.388	2.352	2.21	1.927	1.803	1.282
1972	2.411	2.378	2.243	1.971	1.837	1.306
1973	2.376	2.339	2.192	1.919	1.789	1.269
1974	2.358	2.328	2.206	1.95	1.81	1.256
1975	3.081	3.045	2.902	2.654	2.521	1.64
1976	2.917	2.878	2.722	2.426	2.291	1.829
1977	2.52	2.487	2.353	2.058	1.919	1.435
1978	2.407	2.373	2.236	1.977	1.846	1.32
1979	2.39	2.354	2.208	1.929	1.796	1.28
1980	2.353	2.32	2.185	1.936	1.803	1.249
1981	2.366	2.334	2.206	1.932	1.793	1.251
1982	3.223	3.182	3.015	2.693	2.515	1.587
1983	2.622	2.59	2.46	2.18	2.041	1.554
1984	2.495	2.46	2.318	2.045	1.913	1.383
1985	2.414	2.374	2.214	1.943	1.822	1.33
1986	2.404	2.376	2.26	1.994	1.974	1.48
1987	2.633	2.599	2.465	2.189	2.05	1.577
1988	2.476	2.441	2.302	2.037	1.904	1.371
1989	2.404	2.372	2.244	1.996	1.861	1.323
1990	4.316	4.259	4.038	3.665	3.482	1.988

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	4.316	4.259	4.038	3.665	3.482	1.988
0.0645161290322581	3.223	3.182	3.015	2.693	2.521	1.829
0.0967741935483871	3.081	3.045	2.902	2.654	2.515	1.64
0.129032258064516	2.917	2.878	2.722	2.426	2.291	1.587
0.161290322580645	2.633	2.599	2.465	2.189	2.05	1.577
0.193548387096774	2.622	2.59	2.46	2.18	2.041	1.554
0.225806451612903	2.52	2.487	2.353	2.073	1.974	1.48
0.258064516129032	2.501	2.468	2.332	2.058	1.938	1.445
0.290322580645161	2.495	2.46	2.318	2.045	1.919	1.435
0.32258064516129	2.476	2.441	2.302	2.037	1.915	1.383
0.354838709677419	2.453	2.419	2.281	2.033	1.913	1.371
0.387096774193548	2.425	2.395	2.272	2.018	1.904	1.359
0.419354838709677	2.422	2.391	2.266	2.005	1.899	1.334
0.451612903225806	2.414	2.378	2.26	2.002	1.886	1.33
0.483870967741936	2.411	2.376	2.252	1.996	1.861	1.323
0.516129032258065	2.407	2.374	2.244	1.994	1.86	1.32
0.548387096774194	2.404	2.373	2.243	1.977	1.856	1.319
0.580645161290323	2.404	2.372	2.236	1.971	1.846	1.309
0.612903225806452	2.4	2.371	2.214	1.958	1.837	1.306
0.645161290322581	2.396	2.359	2.212	1.95	1.822	1.298
0.67741935483871	2.39	2.354	2.21	1.943	1.81	1.282
0.709677419354839	2.388	2.352	2.208	1.936	1.805	1.28
0.741935483870968	2.376	2.339	2.206	1.934	1.803	1.274
0.774193548387097	2.366	2.334	2.206	1.932	1.803	1.269
0.806451612903226	2.358	2.328	2.192	1.929	1.796	1.256
0.838709677419355	2.353	2.32	2.185	1.927	1.793	1.251
0.870967741935484	2.331	2.296	2.154	1.919	1.789	1.249
0.903225806451613	2.303	2.27	2.135	1.869	1.732	1.195
0.935483870967742	2.194	2.164	2.042	1.815	1.681	1.091
0.967741935483871	1.714	1.687	1.58	1.367	1.252	0.5536
0.1	3.0646	3.0283	2.884	2.6312	2.4926	1.6347

Average of yearly averages: 1.36292

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: WAbnair2
Metfile: w24243.dvf
PRZM scenario: WAbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid
Description Variable Name Value Units Comments
Molecular weight mwt 327.3 g/mol
Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L
Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.36 kg/ha
Application Efficiency: APPEFF 0.95 fraction
Spray Drift DRFT 0.05 fraction of application rate applied to pond
Application Date Date 23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: NCpeanutSTD
Application Rate: 0.18
Number of Applications: 4
Aerial

Surface Water:
stored as NCbnair4.out
Chemical: Fluazifop-acid
PRZM environment: NCpeanutSTD.txt modified Tueday, 29 May 2007 at 12:58:46
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w13722.dvf modified Wedday, 3 July 2002 at 09:05:50
Water segment concentrations (ppb)

Year Peak 96 hr 21 Day 60 Day 90 Day Yearly

1961	2.161	2.124	1.977	1.79	1.636	0.7251
1962	7.89	7.763	7.414	6.453	5.853	2.869
1963	3.404	3.35	3.178	3.074	2.973	2.378
1964	3.39	3.335	3.233	3.005	2.761	1.729
1965	8.035	7.935	7.447	6.434	5.802	3.111
1966	3.672	3.606	3.39	3.122	2.936	2.431
1967	5.569	5.478	5.185	4.81	4.395	2.449
1968	4.005	3.941	3.733	3.291	3.046	2.193
1969	4.157	4.109	3.866	3.569	3.379	2.13
1970	4.653	4.579	4.307	3.742	3.388	2.204
1971	3.814	3.753	3.56	3.171	2.967	2.042
1972	4.789	4.711	4.5	4.202	3.864	2.227
1973	3.823	3.762	3.587	3.337	3.086	2.115
1974	3.537	3.48	3.299	3.052	2.907	1.873
1975	2.416	2.389	2.302	2.107	1.974	1.421
1976	2.377	2.335	2.17	1.998	1.868	1.201
1977	2.432	2.386	2.203	2.048	1.949	1.256
1978	3.206	3.151	2.963	2.726	2.503	1.487
1979	4.01	3.947	3.75	3.244	2.99	1.845
1980	6.433	6.33	6.131	5.306	4.743	2.617
1981	5.323	5.222	4.844	4.142	3.768	2.523
1982	4.553	4.474	4.24	3.982	3.651	2.329
1983	3.475	3.412	3.249	3.022	2.83	1.839
1984	2.952	2.921	2.786	2.528	2.355	1.538
1985	2.643	2.6	2.438	2.196	2.033	1.352
1986	2.488	2.438	2.278	2.039	1.888	1.218
1987	2.732	2.68	2.497	2.225	2.013	1.243
1988	2.466	2.422	2.261	2.09	1.914	1.219
1989	2.598	2.556	2.448	2.243	2.072	1.272
1990	2.466	2.421	2.298	2.121	1.989	1.234

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	8.035	7.935	7.447	6.453	5.853	3.111
0.0645161290322581	7.89	7.763	7.414	6.434	5.802	2.869
0.0967741935483871	6.433	6.33	6.131	5.306	4.743	2.617
0.129032258064516	5.569	5.478	5.185	4.81	4.395	2.523
0.161290322580645	5.323	5.222	4.844	4.202	3.864	2.449
0.193548387096774	4.789	4.711	4.5	4.142	3.768	2.431
0.225806451612903	4.653	4.579	4.307	3.982	3.651	2.378
0.258064516129032	4.553	4.474	4.24	3.742	3.388	2.329
0.290322580645161	4.157	4.109	3.866	3.569	3.379	2.227
0.32258064516129	4.01	3.947	3.75	3.337	3.086	2.204
0.354838709677419	4.005	3.941	3.733	3.291	3.046	2.193
0.387096774193548	3.823	3.762	3.587	3.244	2.99	2.13
0.419354838709677	3.814	3.753	3.56	3.171	2.973	2.115
0.451612903225806	3.672	3.606	3.39	3.122	2.967	2.042
0.483870967741936	3.537	3.48	3.299	3.074	2.936	1.873
0.516129032258065	3.475	3.412	3.249	3.052	2.907	1.845
0.548387096774194	3.404	3.35	3.233	3.022	2.83	1.839
0.580645161290323	3.39	3.335	3.178	3.005	2.761	1.729
0.612903225806452	3.206	3.151	2.963	2.726	2.503	1.538
0.645161290322581	2.952	2.921	2.786	2.528	2.355	1.487
0.67741935483871	2.732	2.68	2.497	2.243	2.072	1.421
0.709677419354839	2.643	2.6	2.448	2.225	2.033	1.352
0.741935483870968	2.598	2.556	2.438	2.196	2.013	1.272
0.774193548387097	2.488	2.438	2.302	2.121	1.989	1.256

```
0.806451612903226 2.466 2.422 2.298 2.107 1.974 1.243
0.838709677419355 2.466 2.421 2.278 2.09  1.949 1.234
0.870967741935484 2.432 2.389 2.261 2.048 1.914 1.219
0.903225806451613 2.416 2.386 2.203 2.039 1.888 1.218
0.935483870967742 2.377 2.335 2.17  1.998 1.868 1.201
0.967741935483871 2.161 2.124 1.977 1.79  1.636 0.7251

0.1   6.3466      6.2448      6.0364      5.2564      4.7082      2.6076
                              Average of yearly averages:   1.86900333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: NCbnair4
Metfile:    w13722.dvf
PRZM scenario:    NCpeanutSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:    Fluazifop-acid
Description Variable Name     Value Units Comments
Molecular weight  mwt   327.3 g/mol
Henry's Law Const.      henry 1.55E-10    atm-m^3/mol
Vapor Pressure    vapr  2.81E-7     torr
Solubility  sol   7800  mg/L
Kd    Kd    0.26  mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 82    days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0     days  Halfife
Aerobic Soil Metabolism asm   30    days  Halfife
Hydrolysis: pH 5  0     days  Half-life
Hydrolysis: pH 7  0     days  Half-life
Hydrolysis: pH 9  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.18  kg/ha
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  23-05 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    14    days  Set to 0 or delete line for single app.
app. rate 1 apprate           kg/ha
Interval 2  interval    14    days  Set to 0 or delete line for single app.
app. rate 2 apprate           kg/ha
Interval 3  interval    14    days  Set to 0 or delete line for single app.
app. rate 3 apprate           kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Scenario: NCpeanutsSTD
Application Rate: 0.36
Number of Applications: 2

Aerial

Surface Water:
stored as NCbnair2.out
Chemical: Fluazifop-acid
PRZM environment: NCpeanutSTD.txt modified Tueday, 29 May 2007 at 12:58:46
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w13722.dvf modified Wedday, 3 July 2002 at 09:05:50
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.726	1.701	1.624	1.44	1.295	0.5705
1962	5.274	5.197	4.91	4.263	3.836	1.871
1963	3.179	3.133	2.948	2.619	2.411	1.662
1964	2.774	2.73	2.552	2.319	2.125	1.32
1965	5.902	5.821	5.578	4.879	4.403	2.274
1966	3.379	3.33	3.128	2.793	2.562	1.793
1967	8.779	8.656	8.148	7.035	6.33	3.124
1968	4.193	4.132	3.969	3.588	3.317	2.471
1969	5.593	5.509	5.179	4.471	4.038	2.284
1970	2.897	2.856	2.69	2.547	2.403	1.762
1971	3.675	3.618	3.388	3.058	2.802	1.606
1972	4.532	4.472	4.215	3.651	3.296	1.884
1973	3.872	3.813	3.615	3.295	3.039	1.863
1974	4.743	4.678	4.434	4.081	3.745	2.045
1975	2.823	2.781	2.612	2.297	2.13	1.462
1976	3.17	3.122	2.936	2.57	2.329	1.309
1977	3.351	3.302	3.107	2.749	2.5	1.422
1978	3.177	3.126	2.929	2.551	2.28	1.334
1979	3.207	3.165	2.991	2.648	2.435	1.404
1980	3.211	3.16	2.94	2.535	2.342	1.422
1981	2.449	2.423	2.266	2.129	1.963	1.264
1982	6.529	6.43	6.033	5.176	4.629	2.317
1983	5.199	5.125	4.865	4.36	3.972	2.357
1984	3.038	2.99	2.836	2.551	2.358	1.57
1985	2.53	2.492	2.344	2.132	1.94	1.203
1986	2.192	2.153	2.001	1.776	1.626	0.9879
1987	2.465	2.424	2.25	2.015	1.826	1.038
1988	2.488	2.452	2.328	2.044	1.837	1.073
1989	2.906	2.864	2.704	2.331	2.092	1.174
1990	3.424	3.37	3.149	2.765	2.493	1.346

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	8.779	8.656	8.148	7.035	6.33	3.124
0.0645161290322581	6.529	6.43	6.033	5.176	4.629	2.471
0.0967741935483871	5.902	5.821	5.578	4.879	4.403	2.357
0.129032258064516	5.593	5.509	5.179	4.471	4.038	2.317
0.161290322580645	5.274	5.197	4.91	4.36	3.972	2.284
0.193548387096774	5.199	5.125	4.865	4.263	3.836	2.274
0.225806451612903	4.743	4.678	4.434	4.081	3.745	2.045
0.258064516129032	4.532	4.472	4.215	3.651	3.317	1.884
0.290322580645161	4.193	4.132	3.969	3.588	3.296	1.871
0.32258064516129	3.872	3.813	3.615	3.295	3.039	1.863
0.354838709677419	3.675	3.618	3.388	3.058	2.802	1.793
0.387096774193548	3.424	3.37	3.149	2.793	2.562	1.762

0.419354838709677	3.379	3.33	3.128	2.765	2.5	1.662
0.451612903225806	3.351	3.302	3.107	2.749	2.493	1.606
0.483870967741936	3.211	3.165	2.991	2.648	2.435	1.57
0.516129032258065	3.207	3.16	2.948	2.619	2.411	1.462
0.548387096774194	3.179	3.133	2.94	2.57	2.403	1.422
0.580645161290323	3.177	3.126	2.936	2.551	2.358	1.422
0.612903225806452	3.17	3.122	2.929	2.551	2.342	1.404
0.645161290322581	3.038	2.99	2.836	2.547	2.329	1.346
0.67741935483871	2.906	2.864	2.704	2.535	2.28	1.334
0.709677419354839	2.897	2.856	2.69	2.331	2.13	1.32
0.741935483870968	2.823	2.781	2.612	2.319	2.125	1.309
0.774193548387097	2.774	2.73	2.552	2.297	2.092	1.264
0.806451612903226	2.53	2.492	2.344	2.132	1.963	1.203
0.838709677419355	2.488	2.452	2.328	2.129	1.94	1.174
0.870967741935484	2.465	2.424	2.266	2.044	1.837	1.073
0.903225806451613	2.449	2.423	2.25	2.015	1.826	1.038
0.935483870967742	2.192	2.153	2.001	1.776	1.626	0.9879
0.967741935483871	1.726	1.701	1.624	1.44	1.295	0.5705

0.1	5.8711	5.7898	5.5381	4.8382	4.3665	2.353

Average of yearly averages: 1.64041333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: NCbnair2
Metfile: w13722.dvf
PRZM scenario: NCpeanutSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	327.3	g/mol	
Henry's Law Const.	henry	1.55E-10	atm-m^3/mol	
Vapor Pressure	vapr	2.81E-7	torr	
Solubility	sol	7800	mg/L	
Kd	Kd	0.26	mg/L	
Koc	Koc		mg/L	
Photolysis half-life	kdp	0	days	Half-life
Aerobic Aquatic Metabolism	kbacw	82	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	0	days	Halfife
Aerobic Soil Metabolism	asm	30	days	Halfife
Hydrolysis:	pH 5	0	days	Half-life
Hydrolysis:	pH 7	0	days	Half-life
Hydrolysis:	pH 9	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.36	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	
Application Date	Date	23-05	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	14	days	Set to 0 or delete line for single app.
app. rate 1	apprate		kg/ha	

Record 17: FILTRA
    IPSCND 1
    UPTKF
Record 18: PLVKRT
    PLDKRT

FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: MSsoybeanSTD
Application Rate: 0.36
Number of Applications: 2
Aerial

Surface Water:
stored as MSsyair2.out
Chemical: Fluazifop-acid
PRZM environment: MSsoybeanSTD.txt modified Tueday, 29 May 2007 at 12:58:06
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w03940.dvf modified Wedday, 3 July 2002 at 09:05:46
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.479	1.456	1.392	1.333	1.265	0.598
1962	2.059	2.038	1.929	1.714	1.573	0.7991
1963	2.165	2.124	1.978	1.716	1.696	0.9328
1964	4.232	4.18	3.942	3.454	3.13	1.476
1965	1.46	1.443	1.364	1.233	1.169	0.738
1966	2.068	2.046	1.941	1.765	1.64	0.8276
1967	5.244	5.178	4.908	4.43	4.205	2.104
1968	2.964	2.941	2.787	2.487	2.28	1.408
1969	1.368	1.349	1.315	1.237	1.172	0.7026
1970	1.97	1.942	1.825	1.65	1.513	0.7616
1971	4.989	4.936	4.715	4.21	3.819	1.732
1972	2.162	2.132	2.027	1.867	1.755	1.028
1973	2.275	2.255	2.165	1.941	1.772	0.8782
1974	1.356	1.336	1.258	1.199	1.153	0.6478
1975	2.204	2.184	2.076	1.954	1.874	0.9684
1976	2.069	2.044	1.967	1.859	1.749	0.9531
1977	1.331	1.304	1.208	1.139	1.137	0.7077
1978	1.594	1.572	1.529	1.41	1.317	0.6969
1979	4.105	4.051	3.871	3.468	3.402	1.782
1980	8.587	8.502	8.151	7.141	6.422	2.946
1981	2.41	2.367	2.172	1.824	1.767	1.336
1982	2.79	2.74	2.54	2.154	2.068	1.205
1983	2.727	2.691	2.575	2.342	2.102	1.145
1984	2.087	2.059	1.947	1.814	1.723	0.977
1985	2.093	2.069	1.984	1.786	1.696	0.9042
1986	1.432	1.406	1.3	1.259	1.225	0.719
1987	2.657	2.622	2.438	2.039	1.843	1.033
1988	7.822	7.737	7.345	6.452	5.807	2.634
1989	4.515	4.467	4.217	3.913	3.641	2.03
1990	4.997	4.945	4.733	4.248	3.864	1.944

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	8.587	8.502	8.151	7.141	6.422	2.946
0.0645161290322581	7.822	7.737	7.345	6.452	5.807	2.634
0.0967741935483871	5.244	5.178	4.908	4.43	4.205	2.104
0.129032258064516	4.997	4.945	4.733	4.248	3.864	2.03

0.161290322580645	4.989	4.936	4.715	4.21	3.819	1.944
0.193548387096774	4.515	4.467	4.217	3.913	3.641	1.782
0.225806451612903	4.232	4.18	3.942	3.468	3.402	1.732
0.258064516129032	4.105	4.051	3.871	3.454	3.13	1.476
0.290322580645161	2.964	2.941	2.787	2.487	2.28	1.408
0.32258064516129	2.79	2.74	2.575	2.342	2.102	1.336
0.354838709677419	2.727	2.691	2.54	2.154	2.068	1.205
0.387096774193548	2.657	2.622	2.438	2.039	1.874	1.145
0.419354838709677	2.41	2.367	2.172	1.954	1.843	1.033
0.451612903225806	2.275	2.255	2.165	1.941	1.772	1.028
0.483870967741936	2.204	2.184	2.076	1.867	1.767	0.977
0.516129032258065	2.165	2.132	2.027	1.859	1.755	0.9684
0.548387096774194	2.162	2.124	1.984	1.824	1.749	0.9531
0.580645161290323	2.093	2.069	1.978	1.814	1.723	0.9328
0.612903225806452	2.087	2.059	1.967	1.786	1.696	0.9042
0.645161290322581	2.069	2.046	1.947	1.765	1.696	0.8782
0.67741935483871	2.068	2.044	1.941	1.716	1.64	0.8276
0.709677419354839	2.059	2.038	1.929	1.714	1.573	0.7991
0.741935483870968	1.97	1.942	1.825	1.65	1.513	0.7616
0.774193548387097	1.594	1.572	1.529	1.41	1.317	0.738
0.806451612903226	1.479	1.456	1.392	1.333	1.265	0.719
0.838709677419355	1.46	1.443	1.364	1.259	1.225	0.7077
0.870967741935484	1.432	1.406	1.315	1.237	1.172	0.7026
0.903225806451613	1.368	1.349	1.3	1.233	1.169	0.6969
0.935483870967742	1.356	1.336	1.258	1.199	1.153	0.6478
0.967741935483871	1.331	1.304	1.208	1.139	1.137	0.598

0.1	5.2193	5.1547	4.8905	4.4118	4.1709	2.0966

Average of yearly averages: 1.2205

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MSsyair2
Metfile: w03940.dvf
PRZM scenario: MSsoybeanSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	327.3	g/mol	
Henry's Law Const.	henry	1.55E-10	atm-m^3/mol	
Vapor Pressure	vapr	2.81E-7	torr	
Solubility	sol	7800	mg/L	
Kd	Kd	0.26	mg/L	
Koc	Koc		mg/L	
Photolysis half-life	kdp	0	days	Half-life
Aerobic Aquatic Metabolism	kbacw	82	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	0	days	Halfife
Aerobic Soil Metabolism	asm	30	days	Halfife
Hydrolysis:	pH 5	0	days	Half-life
Hydrolysis:	pH 7	0	days	Half-life
Hydrolysis:	pH 9	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI	0	cm	
Application Rate:	TAPP	0.36	kg/ha	
Application Efficiency:	APPEFF	0.95	fraction	
Spray Drift	DRFT	0.05	fraction of application rate applied to pond	

Application Date Date 23-04 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 49 days Set to 0 or delete line for single app.
app. rate 1 apprate 0.09 kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: MSsoybeanSTD
Application Rate: 0.18
Number of Applications:5
Aerial

Surface Water:
stored as MSsyair5.out
Chemical: Fluazifop-acid
PRZM environment: MSsoybeanSTD.txt modified Tueday, 29 May 2007 at 12:58:06
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w03940.dvf modified Wedday, 3 July 2002 at 09:05:46
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	3.32	3.28	3.128	2.978	2.879	1.446
1962	2.686	2.64	2.49	2.252	2.151	1.463
1963	4.499	4.413	4.13	3.627	3.24	1.798
1964	3.603	3.536	3.308	3.071	2.915	1.814
1965	2.238	2.2	2.084	1.871	1.764	1.174
1966	5.097	5.016	4.884	4.393	4.13	2.203
1967	9.122	9.005	8.639	7.978	7.422	4.098
1968	4.849	4.761	4.579	4.106	3.818	2.7
1969	2.64	2.591	2.398	2.174	2.079	1.525
1970	2.916	2.864	2.663	2.348	2.223	1.376
1971	4.927	4.838	4.518	4.224	4.017	2.184
1972	3.551	3.487	3.301	3.115	2.984	1.824
1973	5.465	5.397	5.239	4.725	4.323	2.209
1974	6.386	6.285	5.879	5.058	4.566	2.452
1975	5.904	5.793	5.415	4.626	4.194	2.708
1976	7.898	7.769	7.538	6.603	6.142	3.568
1977	4.948	4.848	4.454	3.889	3.637	2.46
1978	5.952	5.841	5.688	5.361	4.893	2.585
1979	10.45	10.28	9.587	8.273	7.554	4.036
1980	7.824	7.711	7.363	6.655	6.272	3.599
1981	3.759	3.687	3.382	3.273	3.12	2.029
1982	5.269	5.174	4.797	4.284	3.947	2.268
1983	8.58	8.465	8.118	7.143	6.51	3.414
1984	3.946	3.877	3.717	3.562	3.335	2.285
1985	2.645	2.599	2.433	2.326	2.273	1.526
1986	4.932	4.84	4.474	3.841	3.524	1.867
1987	7.105	7.014	6.525	5.58	5.005	2.798
1988	5.184	5.113	4.989	4.86	4.534	2.746
1989	6.185	6.079	5.688	4.933	4.562	2.597

```
1990  5.379 5.274 5.113 4.769 4.388 2.495

Sorted results
Prob. Peak  96 hr 21 Day      60 Day       90 Day       Yearly
0.032258064516129 10.45 10.28 9.587 8.273 7.554 4.098
0.0645161290322581      9.122 9.005 8.639 7.978 7.422 4.036
0.0967741935483871      8.58  8.465 8.118 7.143 6.51  3.599
0.129032258064516 7.898 7.769 7.538 6.655 6.272 3.568
0.161290322580645 7.824 7.711 7.363 6.603 6.142 3.414
0.193548387096774 7.105 7.014 6.525 5.58  5.005 2.798
0.225806451612903 6.386 6.285 5.879 5.361 4.893 2.746
0.258064516129032 6.185 6.079 5.688 5.058 4.566 2.708
0.290322580645161 5.952 5.841 5.688 4.933 4.562 2.7
0.32258064516129  5.904 5.793 5.415 4.86  4.534 2.597
0.354838709677419 5.465 5.397 5.239 4.769 4.388 2.585
0.387096774193548 5.379 5.274 5.113 4.725 4.323 2.495
0.419354838709677 5.269 5.174 4.989 4.626 4.194 2.46
0.451612903225806 5.184 5.113 4.884 4.393 4.13  2.452
0.483870967741936 5.097 5.016 4.797 4.284 4.017 2.285
0.516129032258065 4.948 4.848 4.579 4.224 3.947 2.268
0.548387096774194 4.932 4.84  4.518 4.106 3.818 2.209
0.580645161290323 4.927 4.838 4.474 3.889 3.637 2.203
0.612903225806452 4.849 4.761 4.454 3.841 3.524 2.184
0.645161290322581 4.499 4.413 4.13  3.627 3.335 2.029
0.67741935483871  3.946 3.877 3.717 3.562 3.24  1.867
0.709677419354839 3.759 3.687 3.382 3.273 3.12  1.824
0.741935483870968 3.603 3.536 3.308 3.115 2.984 1.814
0.774193548387097 3.551 3.487 3.301 3.071 2.915 1.798
0.806451612903226 3.32  3.28  3.128 2.978 2.879 1.526
0.838709677419355 2.916 2.864 2.663 2.348 2.273 1.525
0.870967741935484 2.686 2.64  2.49  2.326 2.223 1.463
0.903225806451613 2.645 2.599 2.433 2.252 2.151 1.446
0.935483870967742 2.64  2.591 2.398 2.174 2.079 1.376
0.967741935483871 2.238 2.2   2.084 1.871 1.764 1.174

0.1   8.5118      8.3954      8.06  7.0942      6.4862      3.5959
                              Average of yearly averages:   2.3749

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MSsyair5
Metfile:    w03940.dvf
PRZM scenario:     MSsoybeanSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:     Fluazifop-acid
Description Variable Name      Value Units Comments
Molecular weight  mwt   327.3 g/mol
Henry's Law Const.      henry 1.55E-10    atm-m^3/mol
Vapor Pressure    vapr  2.81E-7     torr
Solubility  sol   7800  mg/L
Kd    Kd    0.26  mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 82    days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0     days  Halfife
Aerobic Soil Metabolism asm   30    days  Halfife
```

```
Hydrolysis: pH 5  0      days  Half-life
Hydrolysis: pH 7  0      days  Half-life
Hydrolysis: pH 9  0      days  Half-life
Method:      CAM   2      integer      See PRZM manual
Incorporation Depth:     DEPI  0      cm
Application Rate: TAPP  0.18  kg/ha
Application Efficiency: APPEFF      0.95  fraction
Spray Drift DRFT  0.05  fraction of application rate applied to pond
Application Date  Date  23-04 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    14     days  Set to 0 or delete line for single app.
app. rate 1 apprate            kg/ha
Interval 2  interval    14     days  Set to 0 or delete line for single app.
app. rate 2 apprate            kg/ha
Interval 3  interval    14     days  Set to 0 or delete line for single app.
app. rate 3 apprate            kg/ha
Interval 4  interval    49     days  Set to 0 or delete line for single app.
app. rate 4 apprate     0.09  kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Scenario: MIbeansSTD
Application Rate: 0.18
Number of Applications: 4
Ground

Surface Water:

```
stored as MIbngd4.out
Chemical: Fluazifop-acid
PRZM environment: MIbeansSTD.txt    modified Tueday, 29 May 2007 at 12:56:44
EXAMS environment: pond298.exv      modified Thuday, 29 August 2002 at
16:33:30
Metfile: w14826.dvf     modified Wedday, 3 July 2002 at 09:05:38
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	3.556	3.513	3.357	3.254	3.071	1.287
1962	5.492	5.425	5.154	4.623	4.329	2.968
1963	4.528	4.479	4.328	4.026	3.889	3.181
1964	7.094	7.002	6.67	6.224	5.923	3.871
1965	4.515	4.462	4.25	4.086	3.999	3.477
1966	5.593	5.527	5.295	5.149	5.005	3.566
1967	5.757	5.689	5.463	5.221	5.104	3.862
1968	9.358	9.241	8.972	8.555	8.085	5.497
1969	7.07	7.007	6.842	6.25	5.89	5.119
1970	6.305	6.221	5.932	5.667	5.523	4.191
1971	6.281	6.205	5.991	5.581	5.267	4.015
1972	5.586	5.514	5.316	4.954	4.666	3.566
1973	3.357	3.347	3.306	3.214	3.135	2.345
1974	2.759	2.735	2.653	2.418	2.287	1.654
1975	7.366	7.312	6.988	6.455	6.128	3.659

1976	4.854	4.84	4.78	4.646	4.538	3.772
1977	4.824	4.792	4.575	4.457	4.264	3.042
1978	4.08	4.026	3.842	3.497	3.287	2.666
1979	5.316	5.254	5.059	4.869	4.605	3.093
1980	10.46	10.32	9.772	9.11	8.596	5.111
1981	6.677	6.586	6.318	5.835	5.68	5.122
1982	4.172	4.126	4.057	3.945	3.86	3.32
1983	5.945	5.852	5.651	5.061	4.687	3.068
1984	5.654	5.578	5.324	4.775	4.445	3.248
1985	3.061	3.052	3.015	2.931	2.864	2.503
1986	5.072	5	4.722	4.404	4.196	2.859
1987	3.735	3.676	3.519	3.292	3.104	2.644
1988	5.261	5.177	4.968	4.553	4.253	2.766
1989	7.081	6.999	6.827	6.256	5.893	4.106
1990	4.364	4.351	4.297	4.177	4.08	3.395

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.0322580645161291	10.46	10.32	9.772	9.11	8.596	5.497
0.0645161290322581	9.358	9.241	8.972	8.555	8.085	5.122
0.0967741935483871	7.366	7.312	6.988	6.455	6.128	5.119
0.129032258064516	7.094	7.007	6.842	6.256	5.923	5.111
0.161290322580645	7.081	7.002	6.827	6.25	5.893	4.191
0.193548387096774	7.07	6.999	6.67	6.224	5.89	4.106
0.225806451612903	6.677	6.586	6.318	5.835	5.68	4.015
0.258064516129032	6.305	6.221	5.991	5.667	5.523	3.871
0.290322580645161	6.281	6.205	5.932	5.581	5.267	3.862
0.32258064516129	5.945	5.852	5.651	5.221	5.104	3.772
0.354838709677419	5.757	5.689	5.463	5.149	5.005	3.659
0.387096774193548	5.654	5.578	5.324	5.061	4.687	3.566
0.419354838709677	5.593	5.527	5.316	4.954	4.666	3.566
0.451612903225806	5.586	5.514	5.295	4.869	4.605	3.477
0.483870967741936	5.492	5.425	5.154	4.775	4.538	3.395
0.516129032258065	5.316	5.254	5.059	4.646	4.445	3.32
0.548387096774194	5.261	5.177	4.968	4.623	4.329	3.248
0.580645161290323	5.072	5	4.78	4.553	4.264	3.181
0.612903225806452	4.854	4.84	4.722	4.457	4.253	3.093
0.645161290322581	4.824	4.792	4.575	4.404	4.196	3.068
0.67741935483871	4.528	4.479	4.328	4.177	4.08	3.042
0.709677419354839	4.515	4.462	4.297	4.086	3.999	2.968
0.741935483870968	4.364	4.351	4.25	4.026	3.889	2.859
0.774193548387097	4.172	4.126	4.057	3.945	3.86	2.766
0.806451612903226	4.08	4.026	3.842	3.497	3.287	2.666
0.838709677419355	3.735	3.676	3.519	3.292	3.135	2.644
0.870967741935484	3.556	3.513	3.357	3.254	3.104	2.503
0.903225806451613	3.357	3.347	3.306	3.214	3.071	2.345
0.935483870967742	3.061	3.052	3.015	2.931	2.864	1.654
0.967741935483871	2.759	2.735	2.653	2.418	2.287	1.287
0.1	7.3388	7.2815	6.9734	6.4351	6.1075	5.1182

Average of yearly averages: 3.43243333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MIbngd4
Metfile: w14826.dvf

PRZM scenario: MIbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid
Description Variable Name Value Units Comments
Molecular weight mwt 327.3 g/mol
Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L
Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.18 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 07-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Interval 2 interval 14 days Set to 0 or delete line for single app.
app. rate 2 apprate kg/ha
Interval 3 interval 14 days Set to 0 or delete line for single app.
app. rate 3 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: MIbeansSTD
Application Rate: 0.18
Number of Applications: 4
Ground

Surface Water:
stored as MIbngd2.out
Chemical: Fluazifop-acid
PRZM environment: MIbeansSTD.txt modified Tueday, 29 May 2007 at 12:56:44
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w14826.dvf modified Wedday, 3 July 2002 at 09:05:38
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.809	1.785	1.711	1.582	1.494	0.7366
1962	4.965	4.909	4.669	4.368	4.146	2.346
1963	5.481	5.439	5.249	4.891	4.665	3.151

1964	5.678	5.601	5.286	4.777	4.583	3.258
1965	3.023	3.014	2.977	2.895	2.833	2.196
1966	8.049	7.953	7.634	7.146	6.696	3.634
1967	7.898	7.798	7.426	6.7	6.243	4.446
1968	13.07	12.97	12.37	11	10.12	6.153
1969	8.129	8.026	7.644	6.816	6.286	5.299
1970	4.554	4.494	4.336	4.012	3.806	3.297
1971	4.479	4.425	4.214	3.894	3.627	2.564
1972	4.097	4.044	3.831	3.631	3.46	2.508
1973	2.227	2.22	2.193	2.132	2.08	1.584
1974	1.82	1.799	1.703	1.561	1.459	1.038
1975	10.06	9.943	9.462	8.383	7.704	3.715
1976	5.817	5.75	5.428	4.804	4.431	3.808
1977	7.751	7.675	7.271	6.394	5.876	3.688
1978	3.595	3.585	3.541	3.443	3.37	2.714
1979	6.317	6.251	5.95	5.294	4.888	2.894
1980	9.144	9.019	8.537	7.557	6.981	4.38
1981	5.894	5.814	5.538	5.147	4.874	4.061
1982	3.703	3.652	3.485	3.348	3.18	2.648
1983	4.675	4.609	4.316	3.825	3.486	2.285
1984	2.384	2.352	2.259	2.031	1.913	1.707
1985	1.756	1.733	1.681	1.536	1.457	1.175
1986	5.693	5.629	5.486	5.107	4.759	2.506
1987	2.851	2.813	2.746	2.669	2.608	2.107
1988	4.459	4.388	4.234	3.743	3.466	2.047
1989	8.321	8.226	7.895	7.398	6.898	4.054
1990	4.129	4.081	3.986	3.875	3.786	3.066

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	13.07	12.97	12.37	11	10.12	6.153
0.0645161290322581	10.06	9.943	9.462	8.383	7.704	5.299
0.0967741935483871	9.144	9.019	8.537	7.557	6.981	4.446
0.129032258064516	8.321	8.226	7.895	7.398	6.898	4.38
0.161290322580645	8.129	8.026	7.644	7.146	6.696	4.061
0.193548387096774	8.049	7.953	7.634	6.816	6.286	4.054
0.225806451612903	7.898	7.798	7.426	6.7	6.243	3.808
0.258064516129032	7.751	7.675	7.271	6.394	5.876	3.715
0.290322580645161	6.317	6.251	5.95	5.294	4.888	3.688
0.32258064516129	5.894	5.814	5.538	5.147	4.874	3.634
0.354838709677419	5.817	5.75	5.486	5.107	4.759	3.297
0.387096774193548	5.693	5.629	5.428	4.891	4.665	3.258
0.419354838709677	5.678	5.601	5.286	4.804	4.583	3.151
0.451612903225806	5.481	5.439	5.249	4.777	4.431	3.066
0.483870967741936	4.965	4.909	4.669	4.368	4.146	2.894
0.516129032258065	4.675	4.609	4.336	4.012	3.806	2.714
0.548387096774194	4.554	4.494	4.316	3.894	3.786	2.648
0.580645161290323	4.479	4.425	4.234	3.875	3.627	2.564
0.612903225806452	4.459	4.388	4.214	3.825	3.486	2.508
0.645161290322581	4.129	4.081	3.986	3.743	3.466	2.506
0.67741935483871	4.097	4.044	3.831	3.631	3.46	2.346
0.709677419354839	3.703	3.652	3.541	3.443	3.37	2.285
0.741935483870968	3.595	3.585	3.485	3.348	3.18	2.196
0.774193548387097	3.023	3.014	2.977	2.895	2.833	2.107
0.806451612903226	2.851	2.813	2.746	2.669	2.608	2.047
0.838709677419355	2.384	2.352	2.259	2.132	2.08	1.707
0.870967741935484	2.227	2.22	2.193	2.031	1.913	1.584

0.903225806451613 1.82 1.799 1.711 1.582 1.494 1.175
0.935483870967742 1.809 1.785 1.703 1.561 1.459 1.038
0.967741935483871 1.756 1.733 1.681 1.536 1.457 0.7366

0.1 9.0617 8.9397 8.4728 7.5411 6.9727 4.4394
Average of yearly averages: 2.96885333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MIbngd2
Metfile: w14826.dvf
PRZM scenario: MIbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid
Description Variable Name Value Units Comments
Molecular weight mwt 327.3 g/mol
Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L
Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.36 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 07-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: ILbeansNMC
Application Rate: 0.18
Number of Applications: 4
Ground

Surface Water:
stored as ILbngd4.out
Chemical: Fluazifop-acid
PRZM environment: ILbeansNMC.txt modified Thuday, 14 June 2007 at 10:16:26

EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w14842.dvf modified Wedday, 3 July 2002 at 09:04:38
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	8.593	8.47	8.113	7.487	6.988	2.881
1962	5.9	5.815	5.563	5.117	4.857	4.22
1963	6.451	6.352	6.063	5.903	5.625	3.995
1964	4.018	3.961	3.811	3.621	3.54	2.96
1965	8.437	8.321	7.854	7.149	6.71	3.808
1966	9.933	9.802	9.299	8.741	8.278	5.485
1967	7.736	7.647	7.454	6.886	6.495	5.357
1968	8.213	8.091	7.772	7.147	6.763	4.907
1969	10.89	10.73	10.09	9.009	8.455	5.556
1970	7.575	7.492	7.239	6.641	6.207	5.31
1971	8.159	8.048	7.601	7.158	6.864	4.816
1972	5.523	5.446	5.255	4.961	4.697	4.104
1973	9.483	9.334	8.841	7.899	7.393	4.605
1974	5.084	5.069	5.007	4.868	4.749	3.412
1975	11.23	11.06	10.62	10.16	9.649	4.796
1976	7.073	6.981	6.863	6.662	6.485	5.603
1977	9.033	8.956	8.49	7.594	7.11	4.813
1978	5.623	5.537	5.235	5.089	4.979	4.124
1979	6.33	6.238	5.918	5.241	4.858	3.286
1980	3.893	3.842	3.6	3.287	3.195	2.758
1981	14.93	14.72	14.36	12.96	12.12	6.174
1982	8.878	8.852	8.742	8.497	8.3	6.94
1983	6.63	6.504	6.065	5.426	5.162	4.47
1984	3.713	3.659	3.514	3.166	3.094	2.711
1985	3.705	3.658	3.475	3.158	2.985	2.228
1986	5.163	5.098	4.863	4.764	4.565	3.016
1987	4.381	4.326	4.159	4.019	3.822	3.071
1988	2.895	2.887	2.851	2.772	2.706	1.813
1989	2.309	2.287	2.231	2.094	1.998	1.266
1990	15	14.78	14.32	13.75	12.99	6.319

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	15	14.78	14.36	13.75	12.99	6.94
0.0645161290322581	14.93	14.72	14.32	12.96	12.12	6.319
0.0967741935483871	11.23	11.06	10.62	10.16	9.649	6.174
0.129032258064516	10.89	10.73	10.09	9.009	8.455	5.603
0.161290322580645	9.933	9.802	9.299	8.741	8.3	5.556
0.193548387096774	9.483	9.334	8.841	8.497	8.278	5.485
0.225806451612903	9.033	8.956	8.742	7.899	7.393	5.357
0.258064516129032	8.878	8.852	8.49	7.594	7.11	5.31
0.290322580645161	8.593	8.47	8.113	7.487	6.988	4.907
0.32258064516129	8.437	8.321	7.854	7.158	6.864	4.816
0.354838709677419	8.213	8.091	7.772	7.149	6.763	4.813
0.387096774193548	8.159	8.048	7.601	7.147	6.71	4.796
0.419354838709677	7.736	7.647	7.454	6.886	6.495	4.605
0.451612903225806	7.575	7.492	7.239	6.662	6.485	4.47
0.483870967741936	7.073	6.981	6.863	6.641	6.207	4.22
0.516129032258065	6.63	6.504	6.065	5.903	5.625	4.124
0.548387096774194	6.451	6.352	6.063	5.426	5.162	4.104
0.580645161290323	6.33	6.238	5.918	5.241	4.979	3.995

0.612903225806452	5.9	5.815	5.563	5.117	4.858	3.808
0.645161290322581	5.623	5.537	5.255	5.089	4.857	3.412
0.67741935483871	5.523	5.446	5.235	4.961	4.749	3.286
0.709677419354839	5.163	5.098	5.007	4.868	4.697	3.071
0.741935483870968	5.084	5.069	4.863	4.764	4.565	3.016
0.774193548387097	4.381	4.326	4.159	4.019	3.822	2.96
0.806451612903226	4.018	3.961	3.811	3.621	3.54	2.881
0.838709677419355	3.893	3.842	3.6	3.287	3.195	2.758
0.870967741935484	3.713	3.659	3.514	3.166	3.094	2.711
0.903225806451613	3.705	3.658	3.475	3.158	2.985	2.228
0.935483870967742	2.895	2.887	2.851	2.772	2.706	1.813
0.967741935483871	2.309	2.287	2.231	2.094	1.998	1.266

0.1 11.196 11.027 10.567 10.0449 9.5296 6.1169
Average of yearly averages: 4.16013333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ILbngd4
Metfile: w14842.dvf
PRZM scenario: ILbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid
Description Variable Name Value Units Comments
Molecular weight mwt 327.3 g/mol
Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L
Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.18 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Interval 2 interval 14 days Set to 0 or delete line for single app.
app. rate 2 apprate kg/ha
Interval 3 interval 14 days Set to 0 or delete line for single app.
app. rate 3 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond

Flag for runoff calc.   RUNOFF   none none, monthly or total(average of entire run)

Scenario: ILbeansNMC
Application Rate: 0.36
Number of Applications: 2
Ground

Surface Water:
stored as ILbngd2.out
Chemical: Fluazifop-acid
PRZM environment: ILbeansNMC.txt   modified Thuday, 14 June 2007 at 10:16:26
EXAMS environment: pond298.exv   modified Thuday, 29 August 2002 at 16:33:30
Metfile: w14842.dvf   modified Wedday, 3 July 2002 at 09:04:38
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	5.466	5.388	5.084	4.476	4.201	1.831
1962	5.246	5.173	5.022	4.479	4.195	2.937
1963	10.31	10.15	9.62	8.485	7.808	4.264
1964	4.81	4.796	4.737	4.606	4.503	2.978
1965	2.64	2.601	2.507	2.38	2.235	1.601
1966	6.421	6.305	5.975	5.325	4.96	2.588
1967	5.493	5.416	5.228	4.767	4.446	3.364
1968	13.03	12.83	12.32	10.87	10.12	5.612
1969	12.44	12.24	11.69	10.3	9.441	6.564
1970	6.028	6.01	5.937	5.773	5.645	4.138
1971	10.25	10.11	9.553	8.457	7.743	4.225
1972	5.813	5.754	5.457	4.948	4.615	3.921
1973	6.351	6.252	5.918	5.17	4.769	3.304
1974	3.534	3.474	3.27	2.949	2.877	2.422
1975	7.654	7.537	7.067	6.195	5.743	3.065
1976	6.361	6.26	6.076	5.733	5.43	3.974
1977	5.627	5.529	5.215	4.637	4.278	3.301
1978	7.089	6.979	6.539	5.702	5.195	3.348
1979	5.3	5.224	4.976	4.55	4.214	3.123
1980	2.824	2.816	2.781	2.704	2.644	1.952
1981	13.4	13.18	12.37	10.88	10.1	5.01
1982	9.43	9.279	8.683	7.875	7.316	5.857
1983	7.951	7.8	7.2	6.905	6.414	4.615
1984	4.417	4.352	4.207	3.713	3.591	3.04
1985	4.121	4.059	3.813	3.487	3.28	2.273
1986	7.416	7.332	6.868	6.034	5.543	3.211
1987	3.491	3.48	3.438	3.338	3.248	2.499
1988	1.698	1.693	1.673	1.627	1.588	1.09
1989	2.044	2.012	1.886	1.677	1.559	0.9019
1990	15.34	15.12	14.45	13.01	12.03	5.521

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	15.34	15.12	14.45	13.01	12.03	6.564
0.0645161290322581	13.4	13.18	12.37	10.88	10.12	5.857
0.0967741935483871	13.03	12.83	12.32	10.87	10.1	5.612
0.129032258064516	12.44	12.24	11.69	10.3	9.441	5.521
0.161290322580645	10.31	10.15	9.62	8.485	7.808	5.01
0.193548387096774	10.25	10.11	9.553	8.457	7.743	4.615

```
0.225806451612903 9.43  9.279 8.683 7.875 7.316 4.264
0.258064516129032 7.951 7.8   7.2   6.905 6.414 4.225
0.290322580645161 7.654 7.537 7.067 6.195 5.743 4.138
0.32258064516129  7.416 7.332 6.868 6.034 5.645 3.974
0.354838709677419 7.089 6.979 6.539 5.773 5.543 3.921
0.387096774193548 6.421 6.305 6.076 5.733 5.43  3.364
0.419354838709677 6.361 6.26  5.975 5.702 5.195 3.348
0.451612903225806 6.351 6.252 5.937 5.325 4.96  3.304
0.483870967741936 6.028 6.01  5.918 5.17  4.769 3.301
0.516129032258065 5.813 5.754 5.457 4.948 4.615 3.211
0.548387096774194 5.627 5.529 5.228 4.767 4.503 3.123
0.580645161290323 5.493 5.416 5.215 4.637 4.446 3.065
0.612903225806452 5.466 5.388 5.084 4.606 4.278 3.04
0.645161290322581 5.3   5.224 5.022 4.55  4.214 2.978
0.67741935483871  5.246 5.173 4.976 4.479 4.201 2.937
0.709677419354839 4.81  4.796 4.737 4.476 4.195 2.588
0.741935483870968 4.417 4.352 4.207 3.713 3.591 2.499
0.774193548387097 4.121 4.059 3.813 3.487 3.28  2.422
0.806451612903226 3.534 3.48  3.438 3.338 3.248 2.273
0.838709677419355 3.491 3.474 3.27  2.949 2.877 1.952
0.870967741935484 2.824 2.816 2.781 2.704 2.644 1.831
0.903225806451613 2.64  2.601 2.507 2.38  2.235 1.601
0.935483870967742 2.044 2.012 1.886 1.677 1.588 1.09
0.967741935483871 1.698 1.693 1.673 1.627 1.559 0.9019

0.1   12.971      12.771      12.257      10.813      10.0341     5.6029
                              Average of yearly averages:   3.41766333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ILbngd2
Metfile:    w14842.dvf
PRZM scenario:    ILbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name:    Fluazifop-acid
Description Variable Name      Value Units Comments
Molecular weight  mwt   327.3 g/mol
Henry's Law Const.      henry 1.55E-10    atm-m^3/mol
Vapor Pressure    vapr  2.81E-7     torr
Solubility  sol   7800  mg/L
Kd    Kd    0.26  mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 82    days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0     days  Halfife
Aerobic Soil Metabolism asm   30    days  Halfife
Hydrolysis: pH 5  0     days  Half-life
Hydrolysis: pH 7  0     days  Half-life
Hydrolysis: pH 9  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.36  kg/ha
Application Efficiency: APPEFF      0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    14    days  Set to 0 or delete line for single app.
```

app. rate 1 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: ORsnbeansSTD
Application Rate: 0.18
Number of Applications: 4
Ground

Surface Water:
stored as ORbngd4.out
Chemical: Fluazifop-acid
PRZM environment: ORsnbeansSTD.txt modified Tueday, 29 May 2007 at 13:01:06
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.78	0.7703	0.7345	0.7059	0.6747	0.3031
1962	0.748	0.7409	0.7339	0.6954	0.6693	0.4929
1963	0.6948	0.6875	0.6584	0.6143	0.5967	0.5233
1964	0.6812	0.6754	0.6525	0.6123	0.5896	0.4767
1965	0.7615	0.7564	0.7342	0.7053	0.6803	0.4969
1966	0.6391	0.6329	0.6108	0.5833	0.5695	0.5211
1967	0.5512	0.5474	0.5331	0.5028	0.4844	0.4216
1968	2.215	2.193	2.111	1.948	1.853	0.8649
1969	9.334	9.246	8.924	8.43	8.114	3.474
1970	6.979	6.949	6.822	6.533	6.309	4.457
1971	7.701	7.642	7.383	6.884	6.585	3.782
1972	5.402	5.381	5.295	5.092	4.923	3.429
1973	2.026	2.019	1.986	1.911	1.85	1.506
1974	1.205	1.201	1.182	1.14	1.104	0.9179
1975	0.8592	0.8508	0.8164	0.7549	0.7259	0.6231
1976	0.9296	0.9202	0.8818	0.832	0.8047	0.608
1977	2.392	2.36	2.256	2.148	2.06	1.028
1978	2.375	2.352	2.272	2.138	2.033	1.57
1979	3.26	3.228	3.096	2.858	2.735	1.695
1980	2.23	2.222	2.19	2.11	2.043	1.475
1981	1.889	1.876	1.825	1.726	1.662	0.9534
1982	1.525	1.511	1.46	1.398	1.347	1.21
1983	3.85	3.819	3.671	3.384	3.219	1.741
1984	2.984	2.956	2.841	2.655	2.547	2.088
1985	2.136	2.13	2.101	2.033	1.974	1.444
1986	1.385	1.378	1.343	1.272	1.222	0.954
1987	4.161	4.116	3.992	3.631	3.385	1.833
1988	2.415	2.406	2.367	2.275	2.201	1.673
1989	1.238	1.233	1.211	1.166	1.132	0.992
1990	0.8832	0.8793	0.8628	0.8273	0.7996	0.6286

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	9.334	9.246	8.924	8.43	8.114	4.457
0.0645161290322581	7.701	7.642	7.383	6.884	6.585	3.782
0.0967741935483871	6.979	6.949	6.822	6.533	6.309	3.474
0.129032258064516	5.402	5.381	5.295	5.092	4.923	3.429
0.161290322580645	4.161	4.116	3.992	3.631	3.385	2.088
0.193548387096774	3.85	3.819	3.671	3.384	3.219	1.833
0.225806451612903	3.26	3.228	3.096	2.858	2.735	1.741
0.258064516129032	2.984	2.956	2.841	2.655	2.547	1.695
0.290322580645161	2.415	2.406	2.367	2.275	2.201	1.673
0.32258064516129	2.392	2.36	2.272	2.148	2.06	1.57
0.354838709677419	2.375	2.352	2.256	2.138	2.043	1.506
0.387096774193548	2.23	2.222	2.19	2.11	2.033	1.475
0.419354838709677	2.215	2.193	2.111	2.033	1.974	1.444
0.451612903225806	2.136	2.13	2.101	1.948	1.853	1.21
0.483870967741936	2.026	2.019	1.986	1.911	1.85	1.028
0.516129032258065	1.889	1.876	1.825	1.726	1.662	0.992
0.548387096774194	1.525	1.511	1.46	1.398	1.347	0.954
0.580645161290323	1.385	1.378	1.343	1.272	1.222	0.9534
0.612903225806452	1.238	1.233	1.211	1.166	1.132	0.9179
0.645161290322581	1.205	1.201	1.182	1.14	1.104	0.8649
0.67741935483871	0.9296	0.9202	0.8818	0.832	0.8047	0.6286
0.709677419354839	0.8832	0.8793	0.8628	0.8273	0.7996	0.6231
0.741935483870968	0.8592	0.8508	0.8164	0.7549	0.7259	0.608
0.774193548387097	0.78	0.7703	0.7345	0.7059	0.6803	0.5233
0.806451612903226	0.7615	0.7564	0.7342	0.7053	0.6747	0.5211
0.838709677419355	0.748	0.7409	0.7339	0.6954	0.6693	0.4969
0.870967741935484	0.6948	0.6875	0.6584	0.6143	0.5967	0.4929
0.903225806451613	0.6812	0.6754	0.6525	0.6123	0.5896	0.4767
0.935483870967742	0.6391	0.6329	0.6108	0.5833	0.5695	0.4216
0.967741935483871	0.5512	0.5474	0.5331	0.5028	0.4844	0.3031
0.1	6.8213	6.7922	6.6693	6.3889	6.1704	3.4695

Average of yearly averages: 1.40608333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORbngd4
Metfile: w24232.dvf
PRZM scenario: ORsnbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	327.3	g/mol	
Henry's Law Const.	henry	1.55E-10	atm-m^3/mol	

```
Vapor Pressure    vapr  2.81E-7      torr
Solubility  sol   7800  mg/L
Kd    Kd    0.26  mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 82    days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0     days  Halfife
Aerobic Soil Metabolism asm   30    days  Halfife
Hydrolysis: pH 5  0     days  Half-life
Hydrolysis: pH 7  0     days  Half-life
Hydrolysis: pH 9  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.18  kg/ha
Application Efficiency: APPEFF      0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    14    days  Set to 0 or delete line for single app.
app. rate 1 apprate           kg/ha
Interval 2  interval    14    days  Set to 0 or delete line for single app.
app. rate 2 apprate           kg/ha
Interval 3  interval    14    days  Set to 0 or delete line for single app.
app. rate 3 apprate           kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Scenario: ORsnbeansSTD
Application Rate: 0.36
Number of Applications: 2
Ground

Surface Water:

```
stored as ORbngd2.out
Chemical: Fluazifop-acid
PRZM environment: ORsnbeansSTD.txt  modified Tueday, 29 May 2007 at 13:01:06
EXAMS environment: pond298.exv      modified Thuday, 29 August 2002 at
16:33:30
Metfile: w24232.dvf     modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)
```

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.437	1.42	1.35	1.214	1.127	0.4834
1962	0.7784	0.7702	0.7366	0.6932	0.6724	0.6081
1963	0.6561	0.6498	0.624	0.5675	0.5404	0.4545
1964	0.5619	0.5555	0.5292	0.4781	0.4658	0.3718
1965	0.5569	0.5503	0.5233	0.4727	0.4562	0.3748
1966	0.5821	0.5758	0.5498	0.495	0.4734	0.385
1967	0.5376	0.5311	0.5048	0.4476	0.4188	0.3392
1968	1.016	1.007	0.9691	0.8946	0.852	0.4939
1969	6.43	6.37	6.162	5.817	5.6	2.728

1970 4.822 4.801 4.714 4.515 4.361 3.107
1971 5.393 5.359 5.174 4.82 4.612 2.929
1972 3.787 3.772 3.712 3.571 3.452 2.437
1973 1.439 1.434 1.411 1.357 1.314 1.09
1974 1.122 1.11 1.071 0.988 0.9204 0.7431
1975 0.694 0.6862 0.6544 0.6115 0.5973 0.5117
1976 1.072 1.06 1.013 0.9328 0.8867 0.5651
1977 1.54 1.52 1.453 1.372 1.313 0.7744
1978 2.551 2.519 2.39 2.226 2.106 1.316
1979 1.848 1.83 1.756 1.622 1.551 1.264
1980 1.265 1.26 1.242 1.197 1.159 0.8922
1981 1.233 1.224 1.191 1.126 1.085 0.648
1982 1.224 1.211 1.157 1.074 1.041 0.8811
1983 2.48 2.454 2.352 2.154 2.05 1.216
1984 1.721 1.705 1.639 1.531 1.469 1.182
1985 1.231 1.227 1.211 1.172 1.138 0.8836
1986 1.76 1.742 1.668 1.512 1.433 0.8817
1987 7.621 7.543 7.21 6.462 6.008 2.838
1988 3.955 3.94 3.876 3.726 3.605 2.549
1989 1.504 1.498 1.471 1.417 1.376 1.155
1990 0.8417 0.838 0.8224 0.7889 0.7626 0.6074

Sorted results
Prob. Peak 96 hr 21 Day 60 Day 90 Day Yearly
0.032258064516129 7.621 7.543 7.21 6.462 6.008 3.107
0.0645161290322581 6.43 6.37 6.162 5.817 5.6 2.929
0.0967741935483871 5.393 5.359 5.174 4.82 4.612 2.838
0.129032258064516 4.822 4.801 4.714 4.515 4.361 2.728
0.161290322580645 3.955 3.94 3.876 3.726 3.605 2.549
0.193548387096774 3.787 3.772 3.712 3.571 3.452 2.437
0.225806451612903 2.551 2.519 2.39 2.226 2.106 1.316
0.258064516129032 2.48 2.454 2.352 2.154 2.05 1.264
0.290322580645161 1.848 1.83 1.756 1.622 1.551 1.216
0.32258064516129 1.76 1.742 1.668 1.531 1.469 1.182
0.354838709677419 1.721 1.705 1.639 1.512 1.433 1.155
0.387096774193548 1.54 1.52 1.471 1.417 1.376 1.09
0.419354838709677 1.504 1.498 1.453 1.372 1.314 0.8922
0.451612903225806 1.439 1.434 1.411 1.357 1.313 0.8836
0.483870967741936 1.437 1.42 1.35 1.214 1.159 0.8817
0.516129032258065 1.265 1.26 1.242 1.197 1.138 0.8811
0.548387096774194 1.233 1.227 1.211 1.172 1.127 0.7744
0.580645161290323 1.231 1.224 1.191 1.126 1.085 0.7431
0.612903225806452 1.224 1.211 1.157 1.074 1.041 0.648
0.645161290322581 1.122 1.11 1.071 0.988 0.9204 0.6081
0.67741935483871 1.072 1.06 1.013 0.9328 0.8867 0.6074
0.709677419354839 1.016 1.007 0.9691 0.8946 0.852 0.5651
0.741935483870968 0.8417 0.838 0.8224 0.7889 0.7626 0.5117
0.774193548387097 0.7784 0.7702 0.7366 0.6932 0.6724 0.4939
0.806451612903226 0.694 0.6862 0.6544 0.6115 0.5973 0.4834
0.838709677419355 0.6561 0.6498 0.624 0.5675 0.5404 0.4545
0.870967741935484 0.5821 0.5758 0.5498 0.495 0.4734 0.385
0.903225806451613 0.5619 0.5555 0.5292 0.4781 0.4658 0.3748

0.935483870967742 0.5569 0.5503 0.5233 0.4727 0.4562
0.3718
0.967741935483871 0.5376 0.5311 0.5048 0.4476 0.4188
0.3392

0.1 5.3359 5.3032 5.128 4.7895 4.5869 2.827
Average of yearly averages: 1.157

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: ORbngd2
Metfile: w24232.dvf
PRZM scenario: ORsnbeansSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid
Description Variable Name Value Units Comments
Molecular weight mwt 327.3 g/mol
Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L
Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.36 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: WAbeansNMC
Application Rate: 0.18
Number of Applications: 4
Ground

Surface Water:
stored as WAbngd4.out
Chemical: Fluazifop-acid
PRZM environment: WAbeansNMC.txt modified Thuday, 14 June 2007 at 10:18:32

EXAMS environment: pond298.exv   modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24243.dvf   modified Wedday, 3 July 2002 at 09:06:34
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.3081	0.3033	0.284	0.2542	0.2418	0.1083
1962	0.4014	0.3968	0.3779	0.35	0.3428	0.2427
1963	0.4801	0.4739	0.4488	0.4145	0.3929	0.3069
1964	0.4574	0.4526	0.4331	0.4021	0.3839	0.2926
1965	0.4501	0.4445	0.4217	0.3901	0.3709	0.2888
1966	0.4466	0.4402	0.4145	0.3801	0.3583	0.2717
1967	0.419	0.4124	0.3862	0.3526	0.3322	0.2491
1968	1.109	1.097	1.05	0.9698	0.9291	0.46
1969	0.7736	0.7713	0.7616	0.74	0.7217	0.574
1970	0.4874	0.4808	0.4537	0.4208	0.4025	0.3497
1971	0.4464	0.442	0.4281	0.4114	0.4015	0.3099
1972	0.4704	0.4639	0.4375	0.4047	0.3858	0.3124
1973	0.4354	0.4297	0.4064	0.3744	0.3549	0.2772
1974	0.4363	0.4303	0.4063	0.3733	0.3523	0.2652
1975	2.414	2.386	2.272	2.074	1.969	0.8431
1976	1.573	1.568	1.548	1.503	1.466	1.08
1977	0.6652	0.6633	0.6553	0.6355	0.618	0.5011
1978	0.4803	0.4745	0.4506	0.4183	0.3989	0.3315
1979	0.4423	0.4362	0.4113	0.3783	0.3584	0.284
1980	0.4314	0.4263	0.4056	0.374	0.3543	0.2655
1981	0.4323	0.4258	0.3995	0.3663	0.355	0.2749
1982	0.8275	0.8172	0.7841	0.7569	0.7249	0.4532
1983	0.5523	0.5448	0.5144	0.4904	0.4749	0.4159
1984	0.4754	0.4693	0.4446	0.412	0.3925	0.3182
1985	0.4367	0.4316	0.411	0.3818	0.3667	0.2901
1986	1.486	1.48	1.435	1.35	1.301	0.5723
1987	1.143	1.139	1.125	1.09	1.06	0.7843
1988	0.5503	0.5436	0.516	0.482	0.4682	0.4148
1989	0.4692	0.4636	0.4409	0.4085	0.3881	0.3132
1990	4.855	4.789	4.538	4.115	3.907	1.514

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	4.855	4.789	4.538	4.115	3.907	1.514
0.0645161290322581	2.414	2.386	2.272	2.074	1.969	1.08
0.0967741935483871	1.573	1.568	1.548	1.503	1.466	0.8431
0.129032258064516	1.486	1.48	1.435	1.35	1.301	0.7843
0.161290322580645	1.143	1.139	1.125	1.09	1.06	0.574
0.193548387096774	1.109	1.097	1.05	0.9698	0.9291	0.5723
0.225806451612903	0.8275	0.8172	0.7841	0.7569	0.7249	0.5011
0.258064516129032	0.7736	0.7713	0.7616	0.74	0.7217	0.46
0.290322580645161	0.6652	0.6633	0.6553	0.6355	0.618	0.4532
0.32258064516129	0.5523	0.5448	0.516	0.4904	0.4749	0.4159
0.354838709677419	0.5503	0.5436	0.5144	0.482	0.4682	0.4148
0.387096774193548	0.4874	0.4808	0.4537	0.4208	0.4025	0.3497

0.419354838709677	0.4803	0.4745	0.4506	0.4183	0.4015	0.3315
0.451612903225806	0.4801	0.4739	0.4488	0.4145	0.3989	0.3182
0.483870967741936	0.4754	0.4693	0.4446	0.412	0.3929	0.3132
0.516129032258065	0.4704	0.4639	0.4409	0.4114	0.3925	0.3124
0.548387096774194	0.4692	0.4636	0.4375	0.4085	0.3881	0.3099
0.580645161290323	0.4574	0.4526	0.4331	0.4047	0.3858	0.3069
0.612903225806452	0.4501	0.4445	0.4281	0.4021	0.3839	0.2926
0.645161290322581	0.4466	0.442	0.4217	0.3901	0.3709	0.2901
0.67741935483871	0.4464	0.4402	0.4145	0.3818	0.3667	0.2888
0.709677419354839	0.4423	0.4362	0.4113	0.3801	0.3584	0.284
0.741935483870968	0.4367	0.4316	0.411	0.3783	0.3583	0.2772
0.774193548387097	0.4363	0.4303	0.4064	0.3744	0.355	0.2749
0.806451612903226	0.4354	0.4297	0.4063	0.374	0.3549	0.2717
0.838709677419355	0.4323	0.4263	0.4056	0.3733	0.3543	0.2655
0.870967741935484	0.4314	0.4258	0.3995	0.3663	0.3523	0.2652
0.903225806451613	0.419	0.4124	0.3862	0.3526	0.3428	0.2491
0.935483870967742	0.4014	0.3968	0.3779	0.35	0.3322	0.2427
0.967741935483871	0.3081	0.3033	0.284	0.2542	0.2418	0.1083

0.1	1.5643	1.5592	1.5367	1.4877	1.4495	0.83722

Average of yearly averages: 0.432153333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: WAbngd4
Metfile: w24243.dvf
PRZM scenario: WAbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	327.3	g/mol	
Henry's Law Const.	henry	1.55E-10	atm-m^3/mol	
Vapor Pressure	vapr	2.81E-7	torr	
Solubility	sol	7800	mg/L	
Kd	Kd	0.26	mg/L	
Koc	Koc		mg/L	
Photolysis half-life	kdp	0	days	Half-life
Aerobic Aquatic Metabolism	kbacw	82	days	Halfife

Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.18 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Interval 2 interval 14 days Set to 0 or delete line for single app.
app. rate 2 apprate kg/ha
Interval 3 interval 14 days Set to 0 or delete line for single app.
app. rate 3 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: WAbeansNMC
Application Rate: 0.36
Number of Applications: 2
Ground

Surface Water:
stored as WAbngd2.out
Chemical: Fluazifop-acid
PRZM environment: WAbeansNMC.txt modified Thuday, 14 June 2007 at 10:18:32
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w24243.dvf modified Wedday, 3 July 2002 at 09:06:34
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.3428	0.3374	0.3159	0.2735	0.2504	0.1107
1962	0.439	0.433	0.4086	0.3631	0.3363	0.2269
1963	0.5192	0.5128	0.4871	0.4332	0.4008	0.2822
1964	0.4962	0.4899	0.4643	0.4166	0.3899	0.2795
1965	0.4947	0.4878	0.4602	0.4072	0.3808	0.2763
1966	0.4865	0.4804	0.4557	0.4022	0.3732	0.2612
1967	0.4667	0.4597	0.4314	0.3742	0.3468	0.2396
1968	0.7489	0.7404	0.7092	0.6551	0.6277	0.3582
1969	0.6264	0.6181	0.5844	0.5239	0.4935	0.4282
1970	0.5147	0.5069	0.4754	0.4159	0.3901	0.3005
1971	0.4876	0.4804	0.4513	0.3967	0.3817	0.2799
1972	0.5122	0.5051	0.4765	0.4189	0.3921	0.2875
1973	0.4836	0.4761	0.4461	0.3905	0.3646	0.2627
1974	0.4739	0.4679	0.4434	0.392	0.364	0.2536
1975	1.731	1.71	1.629	1.487	1.412	0.6472

1976	1.128	1.125	1.111	1.078	1.052	0.8107
1977	0.623	0.6149	0.5819	0.5182	0.4819	0.416
1978	0.5148	0.5075	0.4782	0.423	0.3969	0.2999
1979	0.4876	0.4802	0.4505	0.3937	0.3671	0.2663
1980	0.4733	0.4666	0.4395	0.3894	0.3627	0.2526
1981	0.4742	0.4678	0.4421	0.3873	0.3594	0.2581
1982	1.371	1.353	1.282	1.17	1.086	0.5791
1983	0.7259	0.7171	0.694	0.6696	0.6485	0.53
1984	0.5608	0.5529	0.5212	0.4611	0.4338	0.3413
1985	0.5006	0.4923	0.4592	0.403	0.3794	0.2864
1986	0.9786	0.9743	0.9447	0.8887	0.8572	0.4401
1987	0.7534	0.7511	0.7416	0.7191	0.699	0.5595
1988	0.5603	0.5525	0.5212	0.4616	0.4351	0.3434
1989	0.4993	0.4927	0.4661	0.4146	0.3877	0.2849
1990	3.057	3.016	2.857	2.591	2.461	1.01

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	3.057	3.016	2.857	2.591	2.461	1.01
0.0645161290322581	1.731	1.71	1.629	1.487	1.412	0.8107
0.0967741935483871	1.371	1.353	1.282	1.17	1.086	0.6472
0.129032258064516	1.128	1.125	1.111	1.078	1.052	0.5791
0.161290322580645	0.9786	0.9743	0.9447	0.8887	0.8572	0.5595
0.193548387096774	0.7534	0.7511	0.7416	0.7191	0.699	0.53
0.225806451612903	0.7489	0.7404	0.7092	0.6696	0.6485	0.4401
0.258064516129032	0.7259	0.7171	0.694	0.6551	0.6277	0.4282
0.290322580645161	0.6264	0.6181	0.5844	0.5239	0.4935	0.416
0.32258064516129	0.623	0.6149	0.5819	0.5182	0.4819	0.3582
0.354838709677419	0.5608	0.5529	0.5212	0.4616	0.4351	0.3434
0.387096774193548	0.5603	0.5525	0.5212	0.4611	0.4338	0.3413
0.419354838709677	0.5192	0.5128	0.4871	0.4332	0.4008	0.3005
0.451612903225806	0.5148	0.5075	0.4782	0.423	0.3969	0.2999
0.483870967741936	0.5147	0.5069	0.4765	0.4189	0.3921	0.2875
0.516129032258065	0.5122	0.5051	0.4754	0.4166	0.3901	0.2864
0.548387096774194	0.5006	0.4927	0.4661	0.4159	0.3899	0.2849
0.580645161290323	0.4993	0.4923	0.4643	0.4146	0.3877	0.2822
0.612903225806452	0.4962	0.4899	0.4602	0.4072	0.3817	0.2799
0.645161290322581	0.4947	0.4878	0.4592	0.403	0.3808	0.2795
0.67741935483871	0.4876	0.4804	0.4557	0.4022	0.3794	0.2763
0.709677419354839	0.4876	0.4804	0.4513	0.3967	0.3732	0.2663

0.741935483870968 0.4865 0.4802 0.4505 0.3937 0.3671
0.2627
0.774193548387097 0.4836 0.4761 0.4461 0.392 0.3646
0.2612
0.806451612903226 0.4742 0.4679 0.4434 0.3905 0.364
0.2581
0.838709677419355 0.4739 0.4678 0.4421 0.3894 0.3627
0.2536
0.870967741935484 0.4733 0.4666 0.4395 0.3873 0.3594
0.2526
0.903225806451613 0.4667 0.4597 0.4314 0.3742 0.3468
0.2396
0.935483870967742 0.439 0.433 0.4086 0.3631 0.3363 0.2269
0.967741935483871 0.3428 0.3374 0.3159 0.2735 0.2504
0.1107

0.1 1.3467 1.3302 1.2649 1.1608 1.0826 0.64039
Average of yearly averages: 0.372416666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: WAbngd2
Metfile: w24243.dvf
PRZM scenario: WAbeansNMC.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid
Description Variable Name Value Units Comments
Molecular weight mwt 327.3 g/mol
Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L
Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.36 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 23-06 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond

Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: NCpeanutSTD
Application Rate: 0.18
Number of Applications: 4
Ground

Surface Water:
stored as NCbngd4.out
Chemical: Fluazifop-acid
PRZM environment: NCpeanutSTD.txt modified Tueday, 29 May 2007 at 12:58:46
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w13722.dvf modified Wedday, 3 July 2002 at 09:05:50
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.9414	0.9254	0.8928	0.8071	0.7357	0.3126
1962	6.691	6.584	6.317	5.509	4.997	2.281
1963	2.763	2.754	2.714	2.625	2.539	1.701
1964	2.059	2.026	1.912	1.821	1.676	1.018
1965	6.756	6.677	6.269	5.416	4.883	2.453
1966	2.602	2.593	2.557	2.468	2.385	1.763
1967	4.202	4.156	4.032	3.692	3.363	1.778
1968	2.646	2.604	2.432	2.152	1.952	1.504
1969	2.817	2.786	2.602	2.419	2.294	1.431
1970	3.283	3.231	3.046	2.65	2.4	1.481
1971	2.428	2.389	2.251	1.996	1.849	1.338
1972	3.474	3.417	3.201	3.042	2.796	1.54
1973	2.457	2.42	2.319	2.147	1.975	1.419
1974	2.15	2.122	2.048	1.935	1.859	1.184
1975	1.027	1.016	0.9588	0.861	0.8318	0.6964
1976	0.9123	0.8985	0.87	0.8403	0.778	0.4977
1977	0.9434	0.9298	0.9043	0.88	0.8515	0.547
1978	1.921	1.887	1.755	1.577	1.451	0.8063
1979	2.751	2.708	2.592	2.244	2.04	1.169
1980	5.423	5.336	5.012	4.276	3.815	1.988
1981	4.034	3.957	3.665	3.137	2.848	1.903
1982	3.302	3.252	3.111	2.882	2.618	1.679
1983	2.141	2.11	2.025	1.932	1.791	1.176
1984	1.617	1.6	1.523	1.349	1.254	0.8452
1985	1.179	1.16	1.107	0.9982	0.9224	0.651
1986	1.149	1.126	1.063	0.9355	0.8623	0.5506
1987	1.345	1.323	1.269	1.096	0.9852	0.5901
1988	1.007	0.9925	0.9599	0.895	0.8196	0.543
1989	1.185	1.169	1.125	1.057	0.9717	0.5846
1990	1.073	1.056	1.021	0.9988	0.9358	0.5693

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	6.756	6.677	6.317	5.509	4.997	2.453
0.0645161290322581	6.691	6.584	6.269	5.416	4.883	2.281
0.0967741935483871	5.423	5.336	5.012	4.276	3.815	1.988
0.129032258064516	4.202	4.156	4.032	3.692	3.363	1.903
0.161290322580645	4.034	3.957	3.665	3.137	2.848	1.778
0.193548387096774	3.474	3.417	3.201	3.042	2.796	1.763

```
0.225806451612903 3.302 3.252 3.111 2.882 2.618 1.701
0.258064516129032 3.283 3.231 3.046 2.65  2.539 1.679
0.290322580645161 2.817 2.786 2.714 2.625 2.4   1.54
0.32258064516129  2.763 2.754 2.602 2.468 2.385 1.504
0.354838709677419 2.751 2.708 2.592 2.419 2.294 1.481
0.387096774193548 2.646 2.604 2.557 2.244 2.04  1.431
0.419354838709677 2.602 2.593 2.432 2.152 1.975 1.419
0.451612903225806 2.457 2.42  2.319 2.147 1.952 1.338
0.483870967741936 2.428 2.389 2.251 1.996 1.859 1.184
0.516129032258065 2.15  2.122 2.048 1.935 1.849 1.176
0.548387096774194 2.141 2.11  2.025 1.932 1.791 1.169
0.580645161290323 2.059 2.026 1.912 1.821 1.676 1.018
0.612903225806452 1.921 1.887 1.755 1.577 1.451 0.8452
0.645161290322581 1.617 1.6   1.523 1.349 1.254 0.8063
0.67741935483871  1.345 1.323 1.269 1.096 0.9852      0.6964
0.709677419354839 1.185 1.169 1.125 1.057 0.9717      0.651
0.741935483870968 1.179 1.16  1.107 0.9988      0.9358      0.5901
0.774193548387097 1.149 1.126 1.063 0.9982      0.9224      0.5846
0.806451612903226 1.073 1.056 1.021 0.9355      0.8623      0.5693
0.838709677419355 1.027 1.016 0.9599      0.895 0.8515      0.5506
0.870967741935484 1.007 0.9925      0.9588      0.88  0.8318      0.547
0.903225806451613 0.9434      0.9298      0.9043      0.861 0.8196      0.543
0.935483870967742 0.9414      0.9254      0.8928      0.8403      0.778
      0.4977
0.967741935483871 0.9123      0.8985      0.87  0.8071      0.7357
      0.3126

0.1   5.3009      5.218 4.914 4.2176      3.7698      1.9795
                              Average of yearly averages:   1.19999333333333

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: NCbngd4
Metfile:    w13722.dvf
PRZM scenario:    NCpeanutSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:    Fluazifop-acid
Description Variable Name     Value Units Comments
Molecular weight  mwt   327.3 g/mol
Henry's Law Const.      henry 1.55E-10    atm-m^3/mol
Vapor Pressure    vapr  2.81E-7     torr
Solubility  sol   7800  mg/L
Kd    Kd    0.26  mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 82    days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0     days  Halfife
Aerobic Soil Metabolism asm   30    days  Halfife
Hydrolysis: pH 5  0     days  Half-life
Hydrolysis: pH 7  0     days  Half-life
Hydrolysis: pH 9  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.18  kg/ha
Application Efficiency: APPEFF      0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
```

```
Application Date  Date   23-05 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval     14    days  Set to 0 or delete line for single app.
app. rate 1 apprate            kg/ha
Interval 2  interval     14    days  Set to 0 or delete line for single app.
app. rate 2 apprate            kg/ha
Interval 3  interval     14    days  Set to 0 or delete line for single app.
app. rate 3 apprate            kg/ha
Record 17:  FILTRA
     IPSCND      1
     UPTKF
Record 18:  PLVKRT
     PLDKRT
     FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Scenario: NCpeanutSTD
Application Rate: 0.36
Number of Applications: 2
Ground

Surface Water:
stored as NCbngd2.out
Chemical: Fluazifop-acid
PRZM environment: NCpeanutSTD.txt   modified Tueday, 29 May 2007 at 12:58:46
EXAMS environment: pond298.exv   modified Thuday, 29 August 2002 at 16:33:30
Metfile: w13722.dvf   modified Wedday, 3 July 2002 at 09:05:50
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.3957	0.39	0.3712	0.3353	0.3061	0.1358
1962	3.877	3.82	3.617	3.143	2.828	1.253
1963	1.54	1.518	1.444	1.32	1.22	0.9715
1964	1.318	1.297	1.213	1.052	0.9503	0.6133
1965	4.45	4.389	4.197	3.675	3.309	1.6
1966	1.888	1.861	1.751	1.498	1.373	1.115
1967	7.521	7.415	6.98	6.026	5.421	2.496
1968	2.647	2.636	2.597	2.512	2.433	1.809
1969	4.086	4.025	3.785	3.268	2.945	1.61
1970	1.481	1.458	1.395	1.352	1.313	1.041
1971	2.029	1.998	1.926	1.765	1.614	0.9032
1972	3.114	3.073	2.896	2.503	2.26	1.197
1973	2.238	2.205	2.134	2.018	1.853	1.173
1974	3.245	3.212	3.132	2.865	2.608	1.378
1975	1.152	1.135	1.078	1.032	0.9974	0.7566
1976	1.553	1.53	1.448	1.299	1.169	0.6267
1977	1.717	1.692	1.628	1.469	1.325	0.7367
1978	1.57	1.545	1.451	1.264	1.132	0.664
1979	1.708	1.686	1.593	1.413	1.281	0.7229
1980	1.838	1.809	1.682	1.427	1.269	0.7589
1981	1.189	1.176	1.103	0.9413	0.8507	0.6131
1982	5.114	5.036	4.725	4.053	3.624	1.688
1983	3.68	3.627	3.434	3.157	2.86	1.731
1984	1.406	1.384	1.336	1.271	1.176	0.8963
1985	1.038	1.023	0.9676	0.8418	0.7656	0.5148

1986 0.6105 0.5996 0.5587 0.5103 0.4729 0.3308
1987 1.071 1.053 0.977 0.8216 0.7304 0.3957
1988 0.8887 0.876 0.8453 0.74 0.6637 0.4073
1989 1.276 1.261 1.209 1.05 0.9439 0.5014
1990 1.836 1.806 1.734 1.53 1.37 0.7029

Sorted results
Prob. Peak 96 hr 21 Day 60 Day 90 Day Yearly
0.0322580645161129 7.521 7.415 6.98 6.026 5.421 2.496
0.0645161290322581 5.114 5.036 4.725 4.053 3.624 1.809
0.0967741935483871 4.45 4.389 4.197 3.675 3.309 1.731
0.129032258064516 4.086 4.025 3.785 3.268 2.945 1.688
0.161290322580645 3.877 3.82 3.617 3.157 2.86 1.61
0.193548387096774 3.68 3.627 3.434 3.143 2.828 1.6
0.225806451612903 3.245 3.212 3.132 2.865 2.608 1.378
0.258064516129032 3.114 3.073 2.896 2.512 2.433 1.253
0.290322580645161 2.647 2.636 2.597 2.503 2.26 1.197
0.32258064516129 2.238 2.205 2.134 2.018 1.853 1.173
0.354838709677419 2.029 1.998 1.926 1.765 1.614 1.115
0.387096774193548 1.888 1.861 1.751 1.53 1.373 1.041
0.419354838709677 1.838 1.809 1.734 1.498 1.37 0.9715
0.451612903225806 1.836 1.806 1.682 1.469 1.325 0.9032
0.483870967741936 1.717 1.692 1.628 1.427 1.313 0.8963
0.516129032258065 1.708 1.686 1.593 1.413 1.281 0.7589
0.548387096774194 1.57 1.545 1.451 1.352 1.269 0.7566
0.580645161290323 1.553 1.53 1.448 1.32 1.22 0.7367
0.612903225806452 1.54 1.518 1.444 1.299 1.176 0.7229
0.645161290322581 1.481 1.458 1.395 1.271 1.169 0.7029
0.67741935483871 1.406 1.384 1.336 1.264 1.132 0.664
0.709677419354839 1.318 1.297 1.213 1.052 0.9974 0.6267
0.741935483870968 1.276 1.261 1.209 1.05 0.9503 0.6133
0.774193548387097 1.189 1.176 1.103 1.032 0.9439 0.6131
0.806451612903226 1.152 1.135 1.078 0.9413 0.8507 0.5148
0.838709677419355 1.071 1.053 0.977 0.8418 0.7656 0.5014
0.870967741935484 1.038 1.023 0.9676 0.8216 0.7304 0.4073
0.903225806451613 0.8887 0.876 0.8453 0.74 0.6637 0.3957
0.935483870967742 0.6105 0.5996 0.5587 0.5103 0.4729
0.3308
0.967741935483871 0.3957 0.39 0.3712 0.3353 0.3061
0.1358

0.1 4.4136 4.3526 4.1558 3.6343 3.2726 1.7267
Average of yearly averages: 0.978096666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: NCbngd2
Metfile: w13722.dvf
PRZM scenario: NCpeanutSTD.txt
EXAMS environment file: pond298.exv
Chemical Name: Fluazifop-acid
Description Variable Name Value Units Comments
Molecular weight mwt 327.3 g/mol
Henry's Law Const. henry 1.55E-10 atm-m^3/mol
Vapor Pressure vapr 2.81E-7 torr
Solubility sol 7800 mg/L

Kd Kd 0.26 mg/L
Koc Koc mg/L
Photolysis half-life kdp 0 days Half-life
Aerobic Aquatic Metabolism kbacw 82 days Halfife
Anaerobic Aquatic Metabolism kbacs 0 days Halfife
Aerobic Soil Metabolism asm 30 days Halfife
Hydrolysis: pH 5 0 days Half-life
Hydrolysis: pH 7 0 days Half-life
Hydrolysis: pH 9 0 days Half-life
Method: CAM 2 integer See PRZM manual
Incorporation Depth: DEPI 0 cm
Application Rate: TAPP 0.36 kg/ha
Application Efficiency: APPEFF 0.99 fraction
Spray Drift DRFT 0.01 fraction of application rate applied to pond
Application Date Date 23-05 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1 interval 14 days Set to 0 or delete line for single app.
app. rate 1 apprate kg/ha
Record 17: FILTRA
IPSCND 1
UPTKF
Record 18: PLVKRT
PLDKRT
FEXTRC 0.5
Flag for Index Res. Run IR EPA Pond
Flag for runoff calc. RUNOFF none none, monthly or total(average of entire run)

Scenario: MSsoybeanSTD
Application Rate: 0.18
Number of Applications: 4
Ground

Surface Water:
stored as MSsyair5.out
Chemical: Fluazifop-acid
PRZM environment: MSsoybeanSTD.txt modified Tueday, 29 May 2007 at 12:58:06
EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30
Metfile: w03940.dvf modified Wedday, 3 July 2002 at 09:05:46
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	2.381	2.348	2.249	2.085	1.998	1.005
1962	1.407	1.378	1.264	1.16	1.107	0.8728
1963	3.404	3.339	3.14	2.726	2.42	1.219
1964	2.287	2.26	2.17	2.091	1.957	1.228
1965	0.8377	0.8237	0.7815	0.7067	0.6707	0.536
1966	3.949	3.913	3.746	3.286	3.088	1.569
1967	8.184	8.079	7.65	7.02	6.505	3.512
1968	3.596	3.548	3.36	2.991	2.79	2.066
1969	1.323	1.299	1.205	1.047	1.014	0.8867
1970	1.502	1.475	1.392	1.215	1.142	0.7461
1971	3.614	3.549	3.293	3.158	2.996	1.588
1972	2.326	2.284	2.117	2.039	1.952	1.239
1973	4.439	4.385	4.146	3.724	3.361	1.646
1974	5.167	5.085	4.756	4.065	3.646	1.873
1975	4.993	4.899	4.589	3.921	3.554	2.112

1976	6.842	6.76	6.459	5.597	5.185	2.993
1977	3.628	3.555	3.266	2.871	2.71	1.868
1978	5.042	4.971	4.797	4.365	3.933	2.019
1979	9.355	9.2	8.581	7.383	6.731	3.497
1980	6.827	6.729	6.327	5.735	5.405	3.071
1981	2.747	2.696	2.473	2.219	2.13	1.456
1982	4.14	4.065	3.769	3.367	3.116	1.693
1983	7.638	7.535	7.126	6.173	5.582	2.86
1984	2.724	2.68	2.533	2.436	2.274	1.672
1985	1.443	1.417	1.332	1.26	1.201	0.8974
1986	3.604	3.536	3.268	2.784	2.533	1.271
1987	6.06	5.989	5.576	4.724	4.227	2.245
1988	4.685	4.635	4.432	3.974	3.62	2.183
1989	4.966	4.881	4.562	3.916	3.573	2.015
1990	4.214	4.156	4.067	3.74	3.415	1.917

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	9.355	9.2	8.581	7.383	6.731	3.512
0.0645161290322581	8.184	8.079	7.65	7.02	6.505	3.497
0.0967741935483871	7.638	7.535	7.126	6.173	5.582	3.071
0.129032258064516	6.842	6.76	6.459	5.735	5.405	2.993
0.161290322580645	6.827	6.729	6.327	5.597	5.185	2.86
0.193548387096774	6.06	5.989	5.576	4.724	4.227	2.245
0.225806451612903	5.167	5.085	4.797	4.365	3.933	2.183
0.258064516129032	5.042	4.971	4.756	4.065	3.646	2.112
0.290322580645161	4.993	4.899	4.589	3.974	3.62	2.066
0.32258064516129	4.966	4.881	4.562	3.921	3.573	2.019
0.354838709677419	4.685	4.635	4.432	3.916	3.554	2.015
0.387096774193548	4.439	4.385	4.146	3.74	3.415	1.917
0.419354838709677	4.214	4.156	4.067	3.724	3.361	1.873
0.451612903225806	4.14	4.065	3.769	3.367	3.116	1.868
0.483870967741936	3.949	3.913	3.746	3.286	3.088	1.693
0.516129032258065	3.628	3.555	3.36	3.158	2.996	1.672
0.548387096774194	3.614	3.549	3.293	2.991	2.79	1.646
0.580645161290323	3.604	3.548	3.268	2.871	2.71	1.588
0.612903225806452	3.596	3.536	3.266	2.784	2.533	1.569
0.645161290322581	3.404	3.339	3.14	2.726	2.42	1.456
0.67741935483871	2.747	2.696	2.533	2.436	2.274	1.271
0.709677419354839	2.724	2.68	2.473	2.219	2.13	1.239
0.741935483870968	2.381	2.348	2.249	2.091	1.998	1.228
0.774193548387097	2.326	2.284	2.17	2.085	1.957	1.219
0.806451612903226	2.287	2.26	2.117	2.039	1.952	1.005
0.838709677419355	1.502	1.475	1.392	1.26	1.201	0.8974
0.870967741935484	1.443	1.417	1.332	1.215	1.142	0.8867
0.903225806451613	1.407	1.378	1.264	1.16	1.107	0.8728
0.935483870967742	1.323	1.299	1.205	1.047	1.014	0.7461
0.967741935483871	0.8377	0.8237	0.7815	0.7067	0.6707	0.536
0.1	7.5584	7.4575	7.0593	6.1292	5.5643	3.0632

Average of yearly averages: 1.79186666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MSsyair5

```
Metfile:    w03940.dvf
PRZM scenario:     MSsoybeanSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:     Fluazifop-acid
Description Variable Name     Value Units Comments
Molecular weight  mwt   327.3 g/mol
Henry's Law Const.      henry 1.55E-10    atm-m^3/mol
Vapor Pressure    vapr  2.81E-7      torr
Solubility  sol   7800  mg/L
Kd    Kd    0.26  mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism     kbacw 82     days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0     days  Halfife
Aerobic Soil Metabolism asm   30    days  Halfife
Hydrolysis: pH 5  0     days  Half-life
Hydrolysis: pH 7  0     days  Half-life
Hydrolysis: pH 9  0     days  Half-life
Method:     CAM   2     integer      See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.18  kg/ha
Application Efficiency: APPEFF      0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  23-04 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    14    days  Set to 0 or delete line for single app.
app. rate 1 apprate           kg/ha
Interval 2  interval    14    days  Set to 0 or delete line for single app.
app. rate 2 apprate           kg/ha
Interval 3  interval    14    days  Set to 0 or delete line for single app.
app. rate 3 apprate           kg/ha
Interval 4  interval    49    days  Set to 0 or delete line for single app.
app. rate 4 apprate     0.09  kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Scenario: MSsoybeanSTD
Application Rate: 0.36
Number of Applications: 2
Ground

Surface Water:

```
stored as MSsygd2.out
Chemical: Fluazifop-acid
PRZM environment: MSsoybeanSTD.txt  modified Tueday, 29 May 2007 at 12:58:06
EXAMS environment: pond298.exv      modified Thuday, 29 August 2002 at
16:33:30
Metfile: w03940.dvf     modified Wedday, 3 July 2002 at 09:05:46
Water segment concentrations (ppb)

Year  Peak  96 hr 21 Day      60 Day      90 Day      Yearly
```

1961	0.8598	0.8462	0.7933	0.7526	0.7205	0.3302
1962	1.266	1.253	1.193	1.039	0.9344	0.4715
1963	1.526	1.497	1.4	1.198	1.107	0.6113
1964	3.533	3.489	3.287	2.85	2.556	1.175
1965	0.6433	0.6399	0.6257	0.5951	0.5725	0.3915
1966	1.258	1.244	1.181	1.057	0.9643	0.4624
1967	4.607	4.55	4.313	3.846	3.656	1.777
1968	2.178	2.159	2.048	1.799	1.614	1.057
1969	0.5879	0.5797	0.5464	0.5043	0.4812	0.3454
1970	1.196	1.179	1.108	0.976	0.8793	0.4153
1971	4.326	4.279	4.092	3.617	3.257	1.423
1972	1.406	1.387	1.326	1.207	1.114	0.7027
1973	1.487	1.472	1.421	1.259	1.128	0.5497
1974	0.6291	0.6197	0.5848	0.5367	0.4866	0.2976
1975	1.456	1.435	1.35	1.279	1.242	0.6186
1976	1.319	1.304	1.246	1.147	1.07	0.5917
1977	0.6863	0.6731	0.6208	0.5518	0.5208	0.3558
1978	0.8128	0.8025	0.775	0.7019	0.6477	0.3541
1979	3.432	3.387	3.244	2.86	2.839	1.464
1980	8.03	7.952	7.633	6.656	5.958	2.694
1981	1.843	1.811	1.663	1.381	1.267	1.027
1982	2.139	2.1	1.948	1.634	1.463	0.8861
1983	2.049	2.022	1.944	1.711	1.523	0.8068
1984	1.311	1.293	1.223	1.129	1.085	0.6259
1985	1.292	1.277	1.22	1.09	1.035	0.559
1986	0.7931	0.7783	0.7247	0.6215	0.6041	0.3762
1987	2.004	1.981	1.844	1.542	1.356	0.7067
1988	7.247	7.168	6.805	5.949	5.32	2.37
1989	3.864	3.825	3.612	3.336	3.101	1.733
1990	4.319	4.274	4.101	3.661	3.31	1.648

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129	8.03	7.952	7.633	6.656	5.958	2.694
0.0645161290322581	7.247	7.168	6.805	5.949	5.32	2.37
0.0967741935483871	4.607	4.55	4.313	3.846	3.656	1.777
0.129032258064516	4.326	4.279	4.101	3.661	3.31	1.733
0.161290322580645	4.319	4.274	4.092	3.617	3.257	1.648
0.193548387096774	3.864	3.825	3.612	3.336	3.101	1.464
0.225806451612903	3.533	3.489	3.287	2.86	2.839	1.423
0.258064516129032	3.432	3.387	3.244	2.85	2.556	1.175
0.290322580645161	2.178	2.159	2.048	1.799	1.614	1.057
0.32258064516129	2.139	2.1	1.948	1.711	1.523	1.027
0.354838709677419	2.049	2.022	1.944	1.634	1.463	0.8861
0.387096774193548	2.004	1.981	1.844	1.542	1.356	0.8068
0.419354838709677	1.843	1.811	1.663	1.381	1.267	0.7067
0.451612903225806	1.526	1.497	1.421	1.279	1.242	0.7027
0.483870967741936	1.487	1.472	1.4	1.259	1.128	0.6259
0.516129032258065	1.456	1.435	1.35	1.207	1.114	0.6186
0.548387096774194	1.406	1.387	1.326	1.198	1.107	0.6113
0.580645161290323	1.319	1.304	1.246	1.147	1.085	0.5917
0.612903225806452	1.311	1.293	1.223	1.129	1.07	0.559
0.645161290322581	1.292	1.277	1.22	1.09	1.035	0.5497
0.67741935483871	1.266	1.253	1.193	1.057	0.9643	0.4715
0.709677419354839	1.258	1.244	1.181	1.039	0.9344	0.4624
0.741935483870968	1.196	1.179	1.108	0.976	0.8793	0.4153

```
0.774193548387097 0.8598       0.8462       0.7933       0.7526       0.7205
      0.3915
0.806451612903226 0.8128       0.8025       0.775 0.7019       0.6477
      0.3762
0.838709677419355 0.7931       0.7783       0.7247       0.6215       0.6041
      0.3558
0.870967741935484 0.6863       0.6731       0.6257       0.5951       0.5725
      0.3541
0.903225806451613 0.6433       0.6399       0.6208       0.5518       0.5208
      0.3454
0.935483870967742 0.6291       0.6197       0.5848       0.5367       0.4866
      0.3302
0.967741935483871 0.5879       0.5797       0.5464       0.5043       0.4812
      0.2976

0.1   4.5789      4.5229      4.2918      3.8275      3.6214      1.7726
                              Average of yearly averages:   0.894216666666667

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: MSsygd2
Metfile:    w03940.dvf
PRZM scenario:     MSsoybeanSTD.txt
EXAMS environment file: pond298.exv
Chemical Name:     Fluazifop-acid
Description Variable Name     Value Units Comments
Molecular weight  mwt   327.3 g/mol
Henry's Law Const.      henry 1.55E-10    atm-m^3/mol
Vapor Pressure    vapr  2.81E-7     torr
Solubility  sol   7800  mg/L
Kd    Kd    0.26  mg/L
Koc   Koc         mg/L
Photolysis half-life    kdp   0     days  Half-life
Aerobic Aquatic Metabolism    kbacw 82    days  Halfife
Anaerobic Aquatic Metabolism  kbacs 0     days  Halfife
Aerobic Soil Metabolism asm   30    days  Halfife
Hydrolysis: pH 5  0     days  Half-life
Hydrolysis: pH 7  0     days  Half-life
Hydrolysis: pH 9  0     days  Half-life
Method:     CAM   2     integer     See PRZM manual
Incorporation Depth:    DEPI  0     cm
Application Rate: TAPP  0.36  kg/ha
Application Efficiency: APPEFF      0.99  fraction
Spray Drift DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  23-04 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  interval    49    days  Set to 0 or delete line for single app.
app. rate 1 apprate     0.09  kg/ha
Record 17:  FILTRA
      IPSCND      1
      UPTKF
Record 18:  PLVKRT
      PLDKRT
      FEXTRC      0.5
Flag for Index Res. Run IR    EPA Pond
Flag for runoff calc.   RUNOFF      none  none, monthly or total(average of
entire run)
```

Appendix C: Summary of Toxicity Data for Fluazifop-p-butyl

Terrestrial Invertebrate Data

Honeybee (Apis mellifera), Adult, O, / Fluazifop-butyl, Tech% ai	24 hr LD_{50} 154 ug/Bee ae (180 ug/Bee ai) slope = NA	00093809, 1979 /Acceptable
Honey bee (Apis mellifera), Adult, O, / Fluazifop-butyl formulation, 25EC% ai	24 hr LD_{50} >166 ug/Bee ae (>195 ug/Bee ai) slope = NA	00093809, 1979 /Acceptable
Honey bee (Apis mellifera), Adult, C, / Fluazifop-butyl, Tech% ai	24 hr LD_{50} >205 ug/Bee ae (>240 ug/Bee ai) slope = NA	00093809, 1979 /Acceptable
Honey bee (Apis mellifera), Adult, C, / Fluazifop-butyl formulation, 25 EC% ai	24 hr LD_{50} >81 ug/Bee ae (>95 ug/Bee ai) slope = NA	00093809, 1979 /Acceptable
Honey bee (Apis mellifera), Adult, C, / Fluazifop-P-butyl, 13.8% ai	24 hr LD_{50} 54 ug/Bee ae (63 ug/Bee ai) slope = N.R.	00162453, 1984 /Acceptable

Aquatic Invertebrate Data

Test species, age or size, test type/ test material, % ai	**Measurement endpoint**	**Source (MRID or ACC) / Study Classification**
Water flea (*Daphnia magna*), <24 hr, static, / Fluazifop-butyl, 97.8% ai	48 hr EC_{50} 240 ppm ae (281.2 ppm ai) slope = 5.21	00087490, 1981 /Acceptable
Water flea (*Daphnia magna*), 12 hr, static, / Fluazifop-butyl (PP009), 94.8% ai	48 hr EC_{50} 8.5 ppm ae (10 ppm ai) slope = NA	00087488, 1979 /Acceptable
Water flea (*Daphnia magna*), 12 hr, static, / Fluazifop-butyl (PP009), 25 EC% ai	48 hr EC_{50} 5.5 ppm ae (6.5 ppm ai) slope = NA	00087488, 1979 /Acceptable
Water flea (*Daphnia magna*), 12 hr, static, / Fluazifop-butyl (PP009), 24% ai	48 hr EC_{50} 5.1 ppm ae (6.02 ppm ai) slope = NA	00087489, 1980 /Acceptable
Water flea (*Daphnia magna*), <24 Hr, static, / Fluazifop-p-butyl RS 1:1 racemic, N.R.% ai	48 Hr LC_{50} 473 ppm ae (553.9 ppm ai) slope = N.R.	00162452, 1983 /Supplemental
Water flea (*Daphnia magna*), <24 Hr, static, / Fluazifop-p-butyl RS 7:1 enhanced enantiomer, N.R.% ai	48 Hr LC_{50} 466 ppm ae (545.6 ppm ai) slope = N.R.	00162452, 1983 /Supplemental
Water flea (*Daphnia magna*), <24 Hr, static, / Fluazifop-p-butyl RS 14:1 methanol prepartion, N.R.% ai	48 Hr LC_{50} 352 ppm ae (412.4 ppm ai) slope = N.R.	00162452, 1983 /Supplemental
Water flea (*Daphnia magna*), <24 hr, static, / Fluazifop-butyl, RS11% ai	48 hr EC_{50} 473 ppm ae (553.9 ppm ai) slope = 10.96	00162452, 1983 /Supplemental
Water flea (*Daphnia magna*), <24 hr, static, / Fluazifop-butyl, RS71% ai	48 hr EC_{50} 466 ppm ae (545.6 ppm ai) slope = N.R.	00162452, 1983 /Supplemental
Water flea (*Daphnia magna*), <24 hr, static, / Fluazifop-butyl, RS14% ai	48 hr EC_{50} 352 ppm ae (412.4 ppm ai) slope = N.R.	00162452, 1983 /Supplemental
Fiddler crab (*Uca pugilator*), 1.5 G, flow-through, / Fluazifop-butyl (PP009), 25.4% ai	96 hr LC_{50} 3.5 ppm ae (4.1 ppm ai) slope = NA	00093806, 1980 /Supplemental
Mysid (*Americamysis bahia*), 6-8 D, flow-through, / Fluazifop-butyl (PP009), 98.6% ai	96 hr LC_{50} 0.184 ppm ae (0.216 ppm ai) slope = 4.6	00093805, 1980 /Acceptable

Test species, age or size, test type/ test material, % ai	Measurement endpoint	Source (MRID or ACC) / Study Classification
Mysid (*Americamysis bahia*), N.R., flow-through, / Fluazifop-P-butyl, 92.2% ai	96 hr LC_{50} 0.44 ppm ae (0.51 ppm ai) slope = N.R.	42543201, 1991 /Acceptable
Pink shrimp (*Penaeus duorarum*), 0.21 g, flow-through, / Fluazifop-butyl (PP009), 25.4% ai	96 hr LC_{50} 5.1 ppm ae (6 ppm ai) slope = NA	00093804, 1980 /Acceptable
Pacific oyster (*Crassostrea gigas*), EmbLrv, flow-through, / Fluazifop-butyl (PP009), 98.6% ai	48 hr EC_{50} 0.083 ppm ae (0.097 ppm ai) slope = 5.5 48-hr NOAEC = 0.048 ppm ae (0.056 ppm ai)	00131460, 1982 /Acceptable
Eastern oyster (*Crassostrea virginica*), SPAT, flow-through, / Fluazifop-P-butyl, 90% ai	96 hr EC_{50} 0.40 ppm ae (0.47 ppm ai) slope = 1.45	41900601, 1991 /Supplemental
Mysid (*Americamysis bahia*), 48 hr, flow-through, / Fluazifop-butyl (PP009), 98.6% ai	28 D NOAEL 0.0148 ppm ae (0.0174 ppm ai) slope = 2.1	00093805, 1981 /Supplemental
Water flea (*Daphnia magna*), LifCyc, flow-through, / Fluazifop-butyl, 97.2% ai	21 D NOAEC/LOAEC 85.4/0.213 ppm ae (0.100/0.250 ppm ai) slope = NA	00093807, 1981 /Supplemental

Fish Data

Test species, age or size, test type/ test material, % ai	Measurement endpoint	Source (MRID or ACC) / Study Classification
Bluegill sunfish (*Lepomis macrochirus*), 4.13 g, flow-through, / Fluazifop-butyl, 98.6% ai	96 hr LC_{50} 0.45 ppm ae (0.53 ppm ai) slope = NA	00087485, 1981 /Acceptable
Bluegill sunfish (*Lepomis macrochirus*), 3.31 g, flow-through, / Fluazifop-butyl, 25.8% ai	96 hr LC_{50} 2.28 ppm ae (2.67 ppm ai) slope = NA	00087486, 1981 /Acceptable
Fathead minnow (*Pimephales promelas*), <24 hr, static, / Fluazifop-butyl, 90.2% ai	96 hr LC_{50} 0.32 ppm ae (0.37 ppm ai) slope = 10.6	00093808, 1981 /Supplemental
Rainbow trout (*Oncorhynchus mykiss*), 2.2 g, flow-through, / Fluazifop-butyl, 25.8% ai	96 hr LC_{50} 4.2 ppm ae (4.9 ppm ai) slope = 8.9	00087484, 1981 /Acceptable
Rainbow trout (*Oncorhynchus mykiss*), 6.2 g, static, / Fluazifop-butyl, 98% ai	96 hr LC_{50} 99.9 ppm ae (117 ppm ai) slope = NA	00087483, 1981 /Acceptable
Rainbow trout (*Oncorhynchus mykiss*), NR, flow-through, / Fluazifop-butyl, 93.7% ai	96 hr LC_{50} 1.20 ppm ae (1.41 ppm ai) slope = 15.2	00131458, 1983 /Supplemental
Sheepshead minnow (*Cyprinodon variegatus*), 0.57 g, flow-through, / Fluazifop-butyl (Fusilade 4E), 46.8EC% ai	96 hr LC_{50} 6.86 ppm ae (8.04 ppm ai) slope = 10.1	00152173, 1985 /Acceptable
Sheepshead minnow (*Cyprinodon variegatus*), 0.37 g, flow-through, / Fluazifop-butyl (25EC formulation), 25.4% ai	96 hr LC_{50} 9.4 ppm ae (11 ppm ai) slope = 13.2	ACC070630, 1981 /Acceptable
Fathead minnow (*Pimephales promelas*), ErlyLf, flow-through, / Fluazifop-butyl, 90.2% ai	30 D NOAEC ≥0.203 ppm ae (≥0.238 ppm ai) slope = NA	00093808, 1981 /Supplemental

Avian Data

Test species, age or size, test type/ test material, % ai	Measurement endpoint	Source (MRID or ACC) / Study Classification
Mallard duck (*Anas platyrhynchos*), NR, oral, / Fluazifop-butyl, 93.4% ai	LD_{50} >4270 mg/kg-bw ae (>5000 mg/kg-bw ai) slope = NA	00131457, 1982 /Acceptable

Test species, age or size, test type/ test material, % ai	Measurement endpoint	Source (MRID or ACC) / Study Classification
Mallard duck (*Anas platyrhynchos*), 16 WKS, oral, / Fluazifop-P-butyl, 95.8% ai	LD_{50} >3013 mg/kg ae (>3528 mg/kg ai) slope = N.R.	40829201, 1985 /Acceptable
Mallard duck (*Anas platyrhynchos*), 15 D, dietary, / Fluazifop-butyl, 99.6% ai	8 D LC_{50} >21348 ppm ae (>25000 ppm ai) slope = NA	00087481, 1980 /Supplemental
Mallard duck (*Anas platyrhynchos*), 9 D, dietary, / Fluazifop-P-butyl, 95% ai	8 D LC_{50} >4142 ppm ae (>4850 ppm ai) slope = N.R.	00087481, 1987 /Acceptable
Ring-necked pheasant (*Phasianus colchicus*), 13 D, dietary, / Fluazifop-butyl (Dieldrin), 99.6% ai	8 D LC_{50} ppm ae (20768 ppm ai) slope = NA	00087482, 1982 /Acceptable
Bobwhite quail (*Colinus virginianus*), 11 D, dietary, / Fluazifop-P-butyl, 89.09% ai	8 D LC_{50} >4466 ppm ae (>5230 ppm ai) slope = N.A.	40851401, 1985 /Acceptable
Bobwhite quail (*Colinus virginianus*), 11 D, dietary, / Fluazifop-p-butyl, 95.8% ai	8 D LC_{50} >4466 ppm ae (>5230 ppm ai) slope = N.A.	40859401, 1985 /Acceptable
Bobwhite quail (*Colinus virginianus*), ErlyLf, reproductive study, / Fluazifop-butyl, 99.6% ai	31 Wk NOAEL ≥43 ppm ae (≥50 ppm ai) slope = NA	00093802, 1981 /Supplemental
Mallard duck (*Anas platyrhynchos*), ErlyLf, reproductive study, / Fluazifop-butyl, 99.6% ai	23 Wk LOEL ≥43 ppm ae (≥50 ppm ai) slope = NA	00093801, 1981 /Supplemental

Mammalian Data: From Fluazifop-P-butyl: Revised HED Chapter of the Tolerance Reassessment Eligibility Document (TRED). PC Code: 122809, Case # 2285, DP Barcode: D291903. 2004

Acute Studies with Fluazifop-butyl (PC 122805)			
Guideline No./ Study Type	**MRID No.**	**Results**	**Toxicity Category**
870.1100 Acute oral toxicity/rats (PP009; 97.2%)	00162439 (1983)	LD_{50} = 1940 mg/kg (males) ± 1193-2758 mg/kg LD_{50} = 2653 mg/kg (females) ± 1764-3625 mg/kg	III
870.1200 Acute dermal toxicity/rabbits (PP009; 97.2%)	00162439 (1983)	LD_{50} > 2mL/kg (males and females) or approximately 2000 mg/kg	III
870.1300 Acute inhalation toxicity/rats (PP009; 97%) 79/ISK034/387	46082901, same as 41563701 (1979)	LC_{50} > 2.3 mg/L for 43% with a particle size <5 μm LC_{50} >4.37 mg/L for 83% with a particle size <10 μm	III
870.2400 Acute eye irritation/rabbit (PP009; 93.3%) 79/ILK9/068	00088855 (1979)	Non-irritating	IV
870.2500 Acute dermal irritation/rabbit (PP009; 93.3%) 79ILK8/056	00088853 (1979)	Mild erythema at 72 hours	IV
870.2600 Skin sensitization/GP (PP009; 99.6%) 80/ILK026/349	00088854 (1980)	Not a dermal sensitizer	

Acute Studies with Fluazifop-P-butyl (PC 122809)			
Guideline No./ Study Type	**MRID No.**	**Results**	**Toxicity Category**
870.1100 Acute oral toxicity/rats (PP005; 93.7% & 86.3%)	00162440 (1984)	LD_{50} = 3680 mg/kg for males rats LD_{50} = 2451 mg/kg for female rats	III III
870.1200 Acute dermal toxicity/rabbits (PP005; 93.7% & 86.3%)	00162440 (1984)	LD_{50} > 2000 mg/kg or >1.73 mL/kg	III
870.1300 Acute inhalation [a] toxicity/rats (PP005; 24.6%) CTL/P/3331	41917904 (1991)	LC_{50} > 1.7 mg/L	III
870.2400 Acute eye irritation/rabbit (PP005; 86.3%) CTL/P/856	00162441 (1983)	Mild irritation, cleared within 3 days	IV
870.2500 Acute dermal irritation/rabbit (PP005; 86.3%) CTL/P/856	00162441 (1983)	Slight irritation, cleared within 72 hours	IV
870.2600 Skin sensitization/GP (PP005; 99.6%) 80/ILK026/349	00162441 (1983)	Not a skin sensitizer	

[a] This study was conducted with a mixture of 24.6% fluazifop-P-butyl and 7.0% fenoxyprop-P-ethyl, however, the concentration fluazifop-P-butyl in the inhalation chamber was determined to be 1.7 mg/L. PPOO9 was used to indicate the technical grade of fluazifop-butyl. PPOO5 was used to indicate the technical grade of fluazifop-P-butyl.

Table 4.1b Subchronic, Chronic, Developmental, Reproductive and Other Toxicity Profile on Fluazifop-butyl [FB] and Fluazifop-P-butyl [FPB].		
Guideline No./ Study Type	**MRID No. (year)/ Classification /Doses**	**Results**
870.3100 90-Day oral toxicity (rat) with FB	00093820 (1980) Acceptable/guideline 0, 10, 100, 2000 ppm M: 0, 0.7, 7.1, 144.5 mg/kg/day F; 0, 0.8, 8.0, 161.9 mg/kg/day	NOAEL=0.7 mg/kg/day LOAEL=7.1 mg/kg/day based on liver and kidney histopathology.
870.3100 90-Day oral toxicity (rat) with FPB	46158402 (1985) Acceptable/guideline 0, 10, 100, 2000 ppm —F: 0, 0.5, 5, 100 mg/kg/day	NOAEL=0.5 mg/kg/day LOAEL=5 mg/kg/day based on decreased spleen weight and decreased hematological parameters in males. Dose related testicular weight decrement and cholesterol depression were also seen.
870.3150 90-Day oral toxicity (dog) with FB	00093821 (1980) Acceptable/guideline 0, 5, 25, 125/250 mg/kg/day	NOAEL = 25 mg/kg/day LOAEL = 125/250 mg/kg/day based on multiple pathologies in 3 dogs (2 males and 1 female) killed at 1 month dosed at 250 mg/kg/day. Also seen were body weight loss gut lesions, severe eye lesions and hepatotoxicity. In remaining surviving dogs dosed at 125 mg/kg/day , mild to equivocal liver lesions were seen.
870.3150	46082902 (2001)	NOAEL = M/F: 78.3/79.0 mg/kg/day

Table 4.1b Subchronic, Chronic, Developmental, Reproductive and Other Toxicity Profile on Fluazifop-butyl [FB] and Fluazifop-P-butyl [FPB].		
Guideline No./ Study Type	**MRID No. (year)/ Classification /Doses**	**Results**
90-Day oral toxicity (hamster) with FPB	Acceptable/guideline Males: 0, 19.5, 78.3 or 291.9 mg/kg/day Females: 0, 19.9, 79.0 or 319.6 mg/kg/day	LOAEL = M/F: 291.9/319.6 mg/kg/day based on decreased body weight/body weight gain and food efficiency in males and evidence of liver toxicity; centrilobular eosinophilia/loss of glycogen in males and females.
870.3200 21/28-Day dermal toxicity (rabbit) with FB	00093819 (1980) Acceptable/guideline 0, 100, 500, 2000 mg/kg/day	NOAEL = 100 mg/kg/day LOAEL = 500 mg/kg/day based on death in 1 male and at 2000 mg/kg/day, death 4 males and 5 females, possibly due to kidney failure.
870.3250 90-Day dermal toxicity (species)	Not required	
870.3465 90-Day inhalation toxicity (species)	Not required.	
870.3700a Prenatal developmental in (Sprague Dawley rats) with FB	0008857, 92067047 (1981) Acceptable/guideline 0, 10, 50, 200 mg/kg/day	**Maternal** NOAEL = 200 mg/kg/day LOAEL = None based on maternal weight decrement due to gravid uterine weight decrement. **Developmental** NOAEL=none LOAEL=10 mg/kg/day based on delayed ossification. **Malformations** NOAEL = 50 mg/kg/day LOAEL = 200 mg/kg/day based on diaphragmatic hernia.
870.3700a Developmental toxicity (Sprague Dawley rat) with FB	00088858, 92067048, 92967020 (1981) Acceptable/guideline 0, 1.0, 5.0, 10, 200 mg/kg/day with FB	**Maternal** NOAEL=200 mg/kg/day. LOAEL=None based on maternal weight decrement partially explained by gravid urine weight decrement. **Developmental** NOAEL=1 mg/kg/day. LOAEL=5 mg/kg/day based on fetal weight decrement and increased incidence of small fetuses and delayed ossification. **Malformations** NOAEL= 10 mg/kg/day LOAEL=200 mg/kg/day based on increased incidence of diaphragmatic hernia.
870.3700a Developmental toxicity (Wistar rats) with FPB	46158401 (1991) Acceptable/guideline 0, 0.5, 1.0, 20, 300 mg/kg/day	**Maternal** NOAEL=20 mg/kg/day LOAEL=300 mg/kg/day based on body weight gain decrement. **Developmental** NOAEL=1.0 mg/kg/day LOAEL=20 mg/kg/day based on delayed ossification in skull bones, cervical arches and centrum in fetuses and litters and delayed ossification in the manus and pes.
870.3700a Developmental Toxicity (Wistar rats)	46082903 (1989) Acceptable/guideline	**Maternal** NOAEL=100 mg/kg/day LOAEL= None based no maternal toxicity. **Developmental** NOAEL=2.0 mg/kg/day

Table 4.1b Subchronic, Chronic, Developmental, Reproductive and Other Toxicity Profile on Fluazifop-butyl [FB] and Fluazifop-P-butyl [FPB].		
Guideline No./ Study Type	**MRID No. (year)/ Classification /Doses**	**Results**
with FPB	0, 2, 5 or 100 mg/kg/day	LOAEL=5.0 mg/kg/day based on based on dose related delayed ossification in skull bones [occipital and parietal] in fetuses and litters.
870.3700a Developmental Toxicity (Wistar rats) with FPB	46082013 (1990) Acceptable/guideline 0, 2.0, 5.0, 100 mg/kg/day	**Maternal** NOAEL=100 mg/kg/day LOAEL= None based on no toxic effects **Developmental** NOAEL=2.0 mg/kg/day LOAEL=5.0 mg/kg/day based on delayed ossification in skull bones, sternebrae bipartite, sternebrae and calcenum unossifided in fetuses and litters.
The overall conclusions based on a weight of evidence on the five studies of developmental toxicity in the rat were a NOAEL/LOAEL = 2.0/5.0 mg/kg/day based on fetal weight decrement and delayed ossification.		
870.3700b Developmental toxicity (NZW rabbit) with FB	00088856, 92067049, 92067021 (1981) Acceptable/guideline 0, 10, 30, 90 mg/kg/day	**Maternal** NOAEL=30 mg/kg/day LOAEL=90 mg/kg/day based on abortions. **Developmental** NOAEL=30 mg/kg/day LOAEL=90 mg/kg/day based on nominal increases in delayed ossification, total litter loss, abortions, small fetuses, cloudy eyes all above mean or range of historical controls
870.3700b Developmental toxicity (NZW rabbits) with FPB	46082904 (1993) Acceptable/guideline 0, 2, 10, 50 mg/kg/day	**Maternal** NOAEL=10 mg/kg/day LOAEL=50 mg/kg/day based death, abortions and body weight loss **Developmental** NOAEL=10 mg/kg/day LOAEL=50 mg/kg/day based on increased incidence of 13^{th} rib and delayed ossification in sternebrae 2.
870.3800 Reproduction and fertility effects (rats) with FB	00088859, 92067050 (1981) Acceptable/guideline 0, 10, 80, 250 ppm M/F: 0/0, 0.74/0.88, 5.8/7.1, 21.7/17.5 mg/kg/day	**Parental/Systemic** NOAEL = M/F 0.74/7.1 mg/kg/day LOAEL = M/F 5.8/ 21.7 mg/kg/day based on decreased spleen wt. in males & increased absolute & relative liver & kidney wts. & geriatric nephropathy in females. **Offspring** NOAEL = 7.1 mg/kg/day LOAEL = 21.7 mg/kg/day based on pup viability in f1 and f2 pups during lactational day 1, 4, 11, 18 & 25 and decreased f2 pup weight on lactational day 25. **Reproductive** NOAEL = M/F 0.74/0.88mg/kg/day LOAEL = M/F 5.8/7.1 mg/kg/day based on decreased abs. & rel testes & epididymal weight and in females decreased pituitary & uterine weights. Sperm counts not available.
Conclusions on the 2-generation study on reproduction in the Sprague Dawley rat: The cause of the dose related testes wt decrease in the P0 and F1 generations has not been demonstrated, but no sperm counts, morphology, motility have been conducted to date. Extensive short term studies on testes weight, testes histopathology, and endocrine effects (MRID# 46082911, 46082916, 46082917,46082920 & 46082920, see table 4.1d) failed to find the reason for the testes weight decrement in the rat and hamster. However, since the most sensitive tests for effects on sperm were not conducted (sperm count, motility and morphology as indicated in the 1996 guidelines), it is concluded that testes weight decrement from possible decrements in sperm seen in the rat reproduction and the chronic study in hamsters have not been adequately eliminated. The histology on the testes does not support		

Table 4.1b Subchronic, Chronic, Developmental, Reproductive and Other Toxicity Profile on Fluazifop-butyl [FB] and Fluazifop-P-butyl [FPB].		
Guideline No./ Study Type	**MRID No. (year)/ Classification /Doses**	**Results**
an effect, but histology is insufficiently sensitive to detect an slight effect.		
870.4100a Chronic toxicity (rats)	870.4300 satisfies the requirement	
870.4100b Chronic toxicity (dog) with FB	00131462, 00131463, 92067018 (1982) Acceptable/guideline 0, 5, 25, 125 mg/kg/day	NOAEL = 5 mg/kg/day LOAEL = 25 mg/kg/day based on marginally increased incidence adrenal fatty vacuolation & increased incidence of thymic involution and at 125 mg/kg/day death of 4/6 males and 2/6 females, eye, gastrointestinal tract lesions, adrenal and bone marrow pathology & thymic involution.
870.4200 Carcinogenicity (hamster) with FPB	4534501, 46082905 (2001) Acceptable/guideline 0, 0, 200, 750, 3000 ppm M: 0, 0, 12.5, 47.4, 193.6 mg/kg/day F: 0, 0, 12.1, 45.5, 181.4 mg/kg/day	NOAEL =M/F 12.5/12.1 mg/kg/day LOAEL = 47.5/45.5 mg/kg/day based on based on increased incidence of males with reduced sperm, testicular degeneration, eye cataract changes, liver inflamation and gall stones and in females, increased incidence of ovarian stroma cell/sex chord hyperplasia. **No evidence of carcinogenicity**
870.4300 Chronic/Carcinogenicity (rat) with FB	41563703 (1985) Acceptable/guideline 0, 2, 10, 80, 250 ppm M: 0, 0.10, 0.51, 4.15, 12.3 mg/kg/day F: 0, 0.13, 0.65, 5.2, 16.0 mg/kg/day	NOAEL =M/F 0.51/5.2 mg/kg/day LOAEL =M/F 4.15/16.0 mg/kg/day based on increased mortality & nephropathy exacerbated by respiratory stress, and in females possible increased basal and/or follicular/luteal cysts. **No evidence of carcinogenicity**
870.6100a Acute neurotoxicity in hens with FB	00093818 (1981) Acceptable/guideline 0, 3750, 7500 or 15000 or 15000 mg/kg	Fluazifop-butyl exposed hens showed no evidence of delayed neurotoxicity.
870.6200a Acute neurotoxicity screening battery	Not required	
870.6200b Subchronic neurotoxicity screening battery	Not required	
870.6300 Developmental neurotoxicity	Not required	
870.7485 Metabolism and	00093822 through 00093828 (1981)	Fluazifop-butyl is rapidly hydrolyzed to fluazifop acid by blood enzymes and excreted as the acid and its conjugates in

Table 4.1b Subchronic, Chronic, Developmental, Reproductive and Other Toxicity Profile on Fluazifop-butyl [FB] and Fluazifop-P-butyl [FPB].		
Guideline No./ Study Type	**MRID No. (year)/ Classification /Doses**	**Results**
pharmacokinetics (rats) with FB	Acceptable/guideline 1 mg/kg and 1000 mg/kg	the urine of males and females. Due to biliary excretion parent compound, fluazifop acid and its conjugates are excreted in the feces of males at much higher proportions than in feces of the female. Excretion was complete in 7 days, with the exception of small amounts in the fat in some rats.
870.7600 Dermal penetration (human)		MRID# 46082918 a human study/NG satisfies guideline 870.7600.
NG Comparative metabolism with FB and FPB in rats	00162445, 0012446 (1983) Acceptable/NG 1 mg/kg	FB is hydrolyzed and the [S] enantiomer is converted to the [R] enantiomer. Whether fluazifop-butyl [RS] (50:50) or fluazifop-P-butyl [S] (90:10) is administered, within a hour the blood contained a mixture composed of fluazifop acid in a ratio of [R] 95% and [S] 3%. The two products behaved similarly and reached the same equilibrium within experimental error.
NG Plasma level time course with FB and FPB in rats	46082910 (1998) Acceptable/NG 200 mg/kg	The time course of plasma levels and elimination of the acid metabolite were similar for both fluazifop-butyl and fluazifop-P-butyl. Plasma levels of the acid from both isomers were much higher in males than in females. The data support previous studies.
NG Absorption and excretion study in hamsters with FPB	46082923 (2002) Acceptable/NG 0, 200, 750, 3000 ppm	The study was conducted in two phases, Phase 1- single dose followed by 3 days of unlabeled test material and Phase 2 - 24 hour feeding of labeled test material followed by 3 day of unlabeled test material. Data were consistent with excretion data from other species. The system appeared saturated, since the ratio of the 3000/200 ppm dose levels was much lower than the ratio of respective plasma levels, especially for males.
NG Absorption, excretion and tissue retention in mice with FB	46082925 (1992) Acceptable/NG 1 and 150 mg/kg	Male mice excreted proportionally more in feces and less in urine than females. Although males excreted more than females in the feces and females excreted more than males in the urine, the difference between males and female mice was smaller than with male and female rats. The study showed individual variability in excretion, similar to that found in the rats, dog and human, although analytical deviation may have explained part of the variation.
NG Absorption and excretion in dogs with FB	0093829 (1981) Acceptable/NG 1 mg/kg	One dog showed delayed absorption. Excretion rate similar to females rats. No evidence of biliary excretion.
NG Peroxasome proliferation in mice, rats, hamsters and	46082919 (1988) Acceptable/NG 0, 80, 250, 1000 or 2000	*In vivo* and *in vitro* peroxasome proliferation was studied in the mouse, rat and hamster and in vitro human hepatocytes. Proliferation in hepatocytes from the greatest to the smallest was: mice > rats > hamster >> human. No increase in cell

Table 4.1b Subchronic, Chronic, Developmental, Reproductive and Other Toxicity Profile on Fluazifop-butyl [FB] and Fluazifop-P-butyl [FPB].

Guideline No./ Study Type	MRID No. (year)/ Classification /Doses	Results
humans with FPB	ppm	replication was seen at any dose.
NG Androgen/estrogen activity with FPB & acid; FB & acid metabolite	46082916 (2001) Acceptable/NG	No agonist or antagonist activity was detected for FPB or FB or their acid metabolites. Using recombinant yeast strains expressing human androgen receptor or estrogen receptor, the intrinsic androgenic, anti-androgenic, estrogenic, anti-estrogenic activity of FPB, FB and their respective acid metabolites have been assessed by absorbance in a transcription assay. Positive antagonists were hydrotamoxifen and flutamide, which induced appropriate antagonic activity. Agonistic activity assessed by comparison to 17β-estradiol and dihydrotestosterone; antagonic activity was assessed by inhibition of 17βestradiol and dihydrotestosterone activity. No agonist or antagonic activity was found within 7 orders of magnitude (oom) greater than the conc. of estradiol transcription, 4 oom greater for inhibition of estradiol transcription and 6 oom for agonistic activity of dihydrotestosterone and up to 156 µM antagonist activity by a dose related decrease in dihydrotestosterone-mediated androgenic activity.
NG Dermal absorption in humans with FB	46082918, 46082927, 4153704 (1991) Acceptable/NG 2 mg & 200 mg/person	Dermal absorption was 8.6% at 2 mg/person and 1.9% at 200 mg/person
NG Dermal multidose in humans with FB	46082908 (1989) Acceptable/NG 20 mg	Six male humans were dermally dosed for 5 days at 20 mg/person and the pharmacokinetics followed The study was consistent with other studies in humans, dogs and female rats. Estimated one-half-life was 12.6 to 17.3 hours, which was much more uniform than seen in other studies. There was no evidence of accumulation of the dose.
NG Oral absorption, metabolism and excretion in men with FB	00131464 (1983) Acceptable/NG 0.07mg/kg	Metabolism was similar to the female rat and dog. Absorption was delayed in one man and excretion in the urine was variable with no evidence of biliary excretion.

Appendix D: Risk Quotient (RQ) Method and Levels of Concern (LOCs)

Risk Presumption	RQ	LOC
Birds and Wild Mammals		
Acute Risk	Dietary based: EEC[a] (ppm[b]) / LC_{50} (ppm) Dose based: EEC (mg/kg-bw/d) / LD_{50} (mg/kg-bw/d[c])	0.5
Acute Restricted Use	Dietary based: EEC (ppm) / LC_{50} (ppm) Dose based: EEC (mg/kg-bw/d) / LD_{50} (mg/kg-bw/d)	0.2
Acute Listed Species	Dietary based: EEC (ppm) / LC_{50} (ppm) Dose based: EEC (mg/kg-bw/d) / LD_{50} (mg/kg-bw/d)	0.1
Chronic Risk	Dietary based: EEC (ppm) / NOAEC (ppm) Dose based: EEC (mg/kg-bw/d) / NOAEL (mg/kg-bw/d)	1.0
Aquatic Animals		
Acute Risk	EEC (ppm) / (LC_{50} (ppm) or EC_{50} (ppm))	0.5
Acute Restricted Use	EEC (ppm) / (LC_{50} (ppm) or EC_{50} (ppm))	0.1
Acute Listed Species	EEC (ppm) / (LC_{50} (ppm) or EC_{50} (ppm))	0.05
Chronic Risk	EEC (ppm) / NOAEC (ppm)	1.0
Terrestrial Plants and Plants Inhabiting Semi-Aquatic Areas		
Acute Risk	EEC (lbs ai/A) / EC_{25} (lbs ai/A)	1.0
Acute Listed Use	EEC (lbs ai/A) / (EC_{05} or NOAEC (lbs ai/A))	1.0
Aquatic Plants		
Risk	EEC (ppm) / EC_{50} (ppm)	1.0
Listed Species	EEC (ppm) / (EC_{05} or NOAEC (ppm))	1.0

[a] EEC – estimated environmental concentration
[b] ppm = parts per million
[c] mg/kg-bw/d = milligrams per kilogram of body weight per day

Appendix E: T-REX Calculations

Upper Bound Kenaga Residues For RQ Calculation

[redacted]

Acute and Chronic RQs are based on the Upp Kenaga Residues.

The maximum single day residue estimation is both the acute and reproduction RQs.

RQs reported as "0.00" in the RQ tables be <0.01 in your assessment. This is due to r figure issues in Excel.

Endpoints

[redacted]

[redacted]	[redacted]
[redacted]	59.28
[redacted]	18.00
[redacted]	22.09
[redacted]	2.45

Avian Results

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	44.73	25.51	11.42
[redacted]	20.50	11.69	5.23
[redacted]	25.16	14.35	6.42
[redacted]	2.80	1.50	0.71

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	0.02	0.01	0.00
[redacted]	0.01	0.00	0.00
[redacted]	0.01	0.00	0.00
[redacted]	0.00	0.00	0.00

[redacted]	[redacted]	
[redacted]	Acute	Chronic
[redacted]	0.00	0.79
[redacted]	0.00	0.36
[redacted]	0.00	0.44
[redacted]	0.00	0.05

Note To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available

Fluazifop herbicide Upper bound Kenaga Residues

Mammalian Results

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	37.45	25.88	6.00	[redacted]		
[redacted]	17.16	11.86	2.75			
[redacted]	21.06	14.56	3.38			
[redacted]	2.34	1.62	0.38	0.52	0.36	0.08

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	Acute	Chronic	Acute	Chronic	Acute	Chronic
[redacted]	0.01	23.83	0.01	19.67	0.00	10.54
[redacted]	0.00	10.55	0.00	9.01	0.00	4.83
[redacted]	0.00	12.95	0.00	11.06	0.00	5.93
[redacted]	0.00	1.44	0.00	1.23	0.00	0.66
[redacted]	0.00	0.32	0.00	0.27	0.00	0.15

[redacted]	[redacted]	
[redacted]	Acute	Chronic
[redacted]	#DIV/0!	2.65
[redacted]	#DIV/0!	1.22
[redacted]	#DIV/0!	1.49
[redacted]	#DIV/0!	0.17

Upper Bound Kenaga Residues For RQ Calculation

[redacted]

Acute and Chronic RQs are based on the Upp Kenaga Residues.

The maximum single day residue estimation is both the acute and reproduction RQs.

RQs reported as "0.00" in the RQ tables be <0.01 in your assessment. This is due to r figure issues in Excel.

Endpoints

[redacted]

[redacted]	90.00
	41.25
	50.63
	5.63

Avian Results

[redacted]

[redacted]	102.50	58.45	26.17
	46.98	26.79	11.99
	57.66	32.88	14.72
	6.41	3.65	1.64

[redacted]	0.04	0.02	0.01
	0.02	0.01	0.00
	0.02	0.01	0.00
	0.00	0.00	0.00

[redacted]	Acute	Chronic
	0.00	1.80
	0.00	0.83
	0.00	1.01
	0.00	0.11

Note: To provide risk management with the maximum possible information, it is recommended that both the dose-based and concentration-based RQs be calculated when data are available

Fluazifop herbicide Upper bound Kenaga Residues

Mammalian Results

[redacted]

[redacted]	85.81	58.30	13.75	[redacted]		
	39.33	27.18	6.30			
	48.27	33.36	7.73			
	5.36	3.71	0.86	1.19	0.82	0.19

[redacted]	Acute	Chronic	Acute	Chronic	Acute	Chronic
	0.02	52.76	0.02	45.07	0.01	24.16
	0.01	24.18	0.01	20.66	0.00	11.07
	0.01	29.68	0.01	25.35	0.01	13.59
	0.00	3.30	0.00	2.82	0.00	1.51
	0.00	0.73	0.00	0.63	0.00	0.34

[redacted]	Acute	Chronic
	#DIV/0!	6.08
	#DIV/0!	2.79
	#DIV/0!	3.42
	#DIV/0!	0.38

Appendix F: LOCATES Analysis

Species Listing by State with Use Criteria

No species were excluded
Minimum of 1 Acre.
All Medium Types Reported
Amphibian, Fish, Crustacean, Bivalve, Gastropod, Insect, Monocot, Ferns, Conf/cycds, Coral, Lichen
beans - dry (PR), beans - dry edible, excluding limas, beans - dry edible, excluding limas (irrigated), peanuts for nuts, peanuts for nuts (irrigated), soybeans for beans, soybeans for beans (irrigated)

Alabama

		Taxa	Critical Habitat
Fern, American hart's-tongue	Threatened	Ferns	No
(Asplenium scolopendrium var. americanum)		Terrestrial	
Quillwort, Louisiana	Endangered	Ferns	No
(Isoetes louisianensis)		Freshwater, Terrestrial	
Grass, Tennessee Yellow-eyed	Endangered	Monocot	No
(Xyris tennesseensis)		Terrestrial	
Trillium, Relict	Endangered	Monocot	No
(Trillium reliquum)		Terrestrial	
Water-plantain, Kral's	Threatened	Monocot	No
(Sagittaria secundifolia)		Freshwater	

Arizona

		Taxa	Critical Habitat
Ladies'-tresses, Canelo Hills	Endangered	Monocot	No
(Spiranthes delitescens)		Terrestrial	
Sedge, Navajo	Threatened	Monocot	Yes
(Carex specuicola)		Terrestrial	

California

		Taxa	Critical Habitat
Amole, Cammatta Canyon	Threatened	Monocot	Yes
(Chlorogalum purpureum var. reductum)		Terrestrial	
Amole, Purple	Threatened	Monocot	Yes
(Chlorogalum purpureum var. purpureum)		Terrestrial	
Bluegrass, San Bernardino	Endangered	Monocot	No
(Poa atropurpurea)		Terrestrial	
Brodiaea, Thread-leaved	Threatened	Monocot	Yes
(Brodiaea filifolia)		Terrestrial	
Grass, California Orcutt	Endangered	Monocot	No
(Orcuttia californica)		Vernal pool, Terrestrial	
Grass, Colusa	Threatened	Monocot	No
(Neostapfia colusana)		Vernal pool	
Grass, San Joaquin Valley Orcutt	Threatened	Monocot	Yes
(Orcuttia inaequalis)		Vernal pool	
Grass, Solano	Endangered	Monocot	Yes

(Tuctoria mucronata)		Vernal pool, Terrestrial	
Lily, Western	Endangered	Monocot	No
(Lilium occidentale)		Terrestrial	
Piperia, Yadon's	Endangered	Monocot	No
(Piperia yadonii)		Terrestrial	

Colorado

		Taxa	Critical Habitat
Ladies'-tresses, Ute	Threatened	Monocot	No
(Spiranthes diluvialis)		Terrestrial	

Connecticut

		Taxa	Critical Habitat
Pogonia, Small Whorled	Threatened	Monocot	No
(Isotria medeoloides)		Terrestrial	

Delaware

		Taxa	Critical Habitat
Pink, Swamp	Threatened	Monocot	No
(Helonias bullata)		Terrestrial, Freshwater	
Pogonia, Small Whorled	Threatened	Monocot	No
(Isotria medeoloides)		Terrestrial	

Florida

		Taxa	Critical Habitat
Torreya, Florida	Endangered	Conf/cycds	No
(Torreya taxifolia)		Terrestrial	
Cladonia, Florida Perforate	Endangered	Lichen	No
(Cladonia perforata)		Terrestrial	
Beargrass, Britton's	Endangered	Monocot	No
(Nolina brittoniana)		Terrestrial	

Georgia

		Taxa	Critical Habitat
Torreya, Florida	Endangered	Conf/cycds	No
(Torreya taxifolia)		Terrestrial	
Quillwort, Black-spored	Endangered	Ferns	No
(Isoetes melanospora)		Vernal pool	
Quillwort, Mat-forming	Endangered	Ferns	No
(Isoetes tegetiformans)		Vernal pool	
Grass, Tennessee Yellow-eyed	Endangered	Monocot	No
(Xyris tennesseensis)		Terrestrial	
Pogonia, Small Whorled	Threatened	Monocot	No
(Isotria medeoloides)		Terrestrial	
Trillium, Relict	Endangered	Monocot	No
(Trillium reliquum)		Terrestrial	
Water-plantain, Kral's	Threatened	Monocot	No
(Sagittaria secundifolia)		Freshwater	

Hawaii

		Taxa	Critical Habitat
Diellia pallida (ncn)	Endangered	Ferns	Yes
(Diellia pallida)		Terrestrial	

Fern, Pendant Kihi (Adenophorus periens) *(Adenophorus periens)*	Endangered	Ferns Terrestrial	Yes
Bluegrass, Hawaiian *(Poa sandvicensis)*	Endangered	Monocot Terrestrial	Yes
Bluegrass, Mann's (Poa mannii) *(Poa mannii)*	Endangered	Monocot Terrestrial	Yes
Hilo Ischaemum (Ischaemum byrone) *(Ischaemum byrone)*	Endangered	Monocot Terrestrial	Yes
Lau'ehu (Panicum niihauense) *(Panicum niihauense)*	Endangered	Monocot Terrestrial	Yes
Lo`ulu (Pritchardia napaliensis) *(Pritchardia napaliensis)*	Endangered	Monocot Terrestrial	No
Lo`ulu (Pritchardia viscosa) *(Pritchardia viscosa)*	Endangered	Monocot Terrestrial	No
Mariscus pennatiformis (ncn) *(Mariscus pennatiformis)*	Endangered	Monocot Terrestrial	Yes
Platanthera holochila (ncn) *(Platanthera holochila)*	Endangered	Monocot Terrestrial	Yes
Poa siphonoglossa (ncn) *(Poa siphonoglossa)*	Endangered	Monocot Terrestrial	Yes
Pu'uka'a (Cyperus trachysanthos) *(Cyperus trachysanthos)*	Endangered	Monocot Terrestrial	Yes
Wahane (Pritchardia aylmer-robinsonii) *(Pritchardia aylmer-robinsonii)*	Endangered	Monocot Terrestrial	No

Illinois		**Taxa**	Critical Habitat
Orchid, Eastern Prairie Fringed *(Platanthera leucophaea)*	Threatened	Monocot Terrestrial	No
Pogonia, Small Whorled *(Isotria medeoloides)*	Threatened	Monocot Terrestrial	No

Indiana		**Taxa**	Critical Habitat
Orchid, Eastern Prairie Fringed *(Platanthera leucophaea)*	Threatened	Monocot Terrestrial	No

Iowa		**Taxa**	Critical Habitat
Fern, American hart's-tongue *(Asplenium scolopendrium var. americanum)*	Threatened	Ferns Terrestrial	No
Orchid, Eastern Prairie Fringed *(Platanthera leucophaea)*	Threatened	Monocot Terrestrial	No
Orchid, Western Prairie Fringed *(Platanthera praeclara)*	Threatened	Monocot Terrestrial	No

Kansas		**Taxa**	Critical Habitat
Orchid, Western Prairie Fringed *(Platanthera praeclara)*	Threatened	Monocot Terrestrial	No

Maine		**Taxa**	Critical Habitat
Orchid, Eastern Prairie Fringed *(Platanthera leucophaea)*	Threatened	Monocot Terrestrial	No
Pogonia, Small Whorled	Threatened	Monocot	No

(Isotria medeoloides)		Terrestrial	

Maryland

		Taxa	Critical Habitat
Bulrush, Northeastern (=Barbed Bristle) *(Scirpus ancistrochaetus)*	Endangered	Monocot Terrestrial, Freshwater	No
Pink, Swamp *(Helonias bullata)*	Threatened	Monocot Terrestrial, Freshwater	No

Massachusetts

		Taxa	Critical Habitat
Pogonia, Small Whorled *(Isotria medeoloides)*	Threatened	Monocot Terrestrial	No

Michigan

		Taxa	Critical Habitat
Iris, Dwarf Lake *(Iris lacustris)*	Threatened	Monocot Terrestrial	No
Orchid, Eastern Prairie Fringed *(Platanthera leucophaea)*	Threatened	Monocot Terrestrial	No
Pogonia, Small Whorled *(Isotria medeoloides)*	Threatened	Monocot Terrestrial	No

Minnesota

		Taxa	Critical Habitat
Lily, Minnesota Trout *(Erythronium propullans)*	Endangered	Monocot Terrestrial	No
Orchid, Western Prairie Fringed *(Platanthera praeclara)*	Threatened	Monocot Terrestrial	No

Mississippi

		Taxa	Critical Habitat
Quillwort, Louisiana *(Isoetes louisianensis)*	Endangered	Ferns Freshwater, Terrestrial	No

Missouri

		Taxa	Critical Habitat
Orchid, Western Prairie Fringed *(Platanthera praeclara)*	Threatened	Monocot Terrestrial	No

Nebraska

		Taxa	Critical Habitat
Orchid, Western Prairie Fringed *(Platanthera praeclara)*	Threatened	Monocot Terrestrial	No

New Hampshire

		Taxa	Critical Habitat
Pogonia, Small Whorled *(Isotria medeoloides)*	Threatened	Monocot Terrestrial	No

New Jersey

		Taxa	Critical Habitat

Beaked-rush, Knieskern's	Threatened	Monocot	No
(Rhynchospora knieskernii)		Terrestrial	
Pink, Swamp	Threatened	Monocot	No
(Helonias bullata)		Terrestrial, Freshwater	
Pogonia, Small Whorled	Threatened	Monocot	No
(Isotria medeoloides)		Terrestrial	

New York

		Taxa	Critical Habitat
Pogonia, Small Whorled	Threatened	Monocot	No
(Isotria medeoloides)		Terrestrial	

North Carolina

		Taxa	Critical Habitat
Lichen, Rock Gnome	Endangered	Lichen	No
(Gymnoderma lineare)		Terrestrial	
Arrowhead, Bunched	Endangered	Monocot	No
(Sagittaria fasciculata)		Freshwater	
Irisette, White	Endangered	Monocot	No
(Sisyrinchium dichotomum)		Terrestrial	
Pink, Swamp	Threatened	Monocot	No
(Helonias bullata)		Terrestrial, Freshwater	
Pogonia, Small Whorled	Threatened	Monocot	No
(Isotria medeoloides)		Terrestrial	
Sedge, Golden	Endangered	Monocot	No
(Carex lutea)		Terrestrial	

North Dakota

		Taxa	Critical Habitat
Orchid, Western Prairie Fringed	Threatened	Monocot	No
(Platanthera praeclara)		Terrestrial	

Ohio

		Taxa	Critical Habitat
Mucket, Pink (Pearlymussel)	Endangered	Bivalve	No
(Lampsilis abrupta)		Freshwater	
Mussel, Clubshell	Endangered	Bivalve	No
(Pleurobema clava)		Freshwater	
Orchid, Eastern Prairie Fringed	Threatened	Monocot	No
(Platanthera leucophaea)		Terrestrial	
Pogonia, Small Whorled	Threatened	Monocot	No
(Isotria medeoloides)		Terrestrial	

Oklahoma

		Taxa	Critical Habitat
Orchid, Eastern Prairie Fringed	Threatened	Monocot	No
(Platanthera leucophaea)		Terrestrial	
Orchid, Western Prairie Fringed	Threatened	Monocot	No
(Platanthera praeclara)		Terrestrial	

Pennsylvania

		Taxa	Critical Habitat
Bulrush, Northeastern (=Barbed Bristle) *(Scirpus ancistrochaetus)*	Endangered	Monocot Terrestrial, Freshwater	No
Pogonia, Small Whorled *(Isotria medeoloides)*	Threatened	Monocot Terrestrial	No

Puerto Rico

		Taxa	Critical Habitat
Fern, Elaphoglossum serpens *(Elaphoglossum serpens)*	Endangered	Ferns Terrestrial	No
Fern, Thelypteris inabonensis *(Thelypteris inabonensis)*	Endangered	Ferns Terrestrial	No
Fern, Thelypteris yaucoensis *(Thelypteris yaucoensis)*	Endangered	Ferns Terrestrial	No
Polystichum calderonense (ncn) *(Polystichum calderonense)*	Endangered	Ferns Terrestrial	No
Tree Fern, Elfin *(Cyathea dryopteroides)*	Endangered	Ferns Terrestrial	No
Aristida chaseae (ncn) *(Aristida chaseae)*	Endangered	Monocot Terrestrial	No
Lepanthes eltorensis (ncn) *(Lepanthes eltoroensis)*	Endangered	Monocot Terrestrial	No
Manaca, palma de *(Calyptronoma rivalis)*	Threatened	Monocot Terrestrial	No
Pelos del Diablo *(Aristida portoricensis)*	Endangered	Monocot Terrestrial	No

South Carolina

		Taxa	Critical Habitat
Quillwort, Black-spored *(Isoetes melanospora)*	Endangered	Ferns Vernal pool	No
Lichen, Rock Gnome *(Gymnoderma lineare)*	Endangered	Lichen Terrestrial	No
Arrowhead, Bunched *(Sagittaria fasciculata)*	Endangered	Monocot Freshwater	No
Irisette, White *(Sisyrinchium dichotomum)*	Endangered	Monocot Terrestrial	No
Pink, Swamp *(Helonias bullata)*	Threatened	Monocot Terrestrial, Freshwater	No
Pogonia, Small Whorled *(Isotria medeoloides)*	Threatened	Monocot Terrestrial	No
Trillium, Persistent *(Trillium persistens)*	Endangered	Monocot Terrestrial	No
Trillium, Relict *(Trillium reliquum)*	Endangered	Monocot Terrestrial	No

South Dakota

		Taxa	Critical Habitat
Orchid, Western Prairie Fringed *(Platanthera praeclara)*	Threatened	Monocot Terrestrial	No

Tennessee

		Taxa	Critical Habitat
Fern, American hart's-tongue *(Asplenium scolopendrium var. americanum)*	Threatened	Ferns Terrestrial	No
Lichen, Rock Gnome *(Gymnoderma lineare)*	Endangered	Lichen Terrestrial	No
Grass, Tennessee Yellow-eyed *(Xyris tennesseensis)*	Endangered	Monocot Terrestrial	No
Pogonia, Small Whorled *(Isotria medeoloides)*	Threatened	Monocot Terrestrial	No

Texas

		Taxa	Critical Habitat
Ladies'-tresses, Navasota *(Spiranthes parksii)*	Endangered	Monocot Terrestrial	No
Wild-rice, Texas *(Zizania texana)*	Endangered	Monocot Freshwater	Yes

Utah

		Taxa	Critical Habitat
Ladies'-tresses, Ute *(Spiranthes diluvialis)*	Threatened	Monocot Terrestrial	No
Sedge, Navajo *(Carex specuicola)*	Threatened	Monocot Terrestrial	Yes

Virginia

		Taxa	Critical Habitat
Bulrush, Northeastern (=Barbed Bristle) *(Scirpus ancistrochaetus)*	Endangered	Monocot Terrestrial, Freshwater	No
Orchid, Eastern Prairie Fringed *(Platanthera leucophaea)*	Threatened	Monocot Terrestrial	No
Pink, Swamp *(Helonias bullata)*	Threatened	Monocot Terrestrial, Freshwater	No
Pogonia, Small Whorled *(Isotria medeoloides)*	Threatened	Monocot Terrestrial	No

West Virginia

		Taxa	Critical Habitat
Bulrush, Northeastern (=Barbed Bristle) *(Scirpus ancistrochaetus)*	Endangered	Monocot Terrestrial, Freshwater	No

Wisconsin

		Taxa	Critical Habitat
Iris, Dwarf Lake *(Iris lacustris)*	Threatened	Monocot Terrestrial	No
Orchid, Eastern Prairie Fringed *(Platanthera leucophaea)*	Threatened	Monocot Terrestrial	No

No species were selected for exclusion. Dispersed species included in report.

8/6/2008 12:51:19 PM Ver. 2.10.3